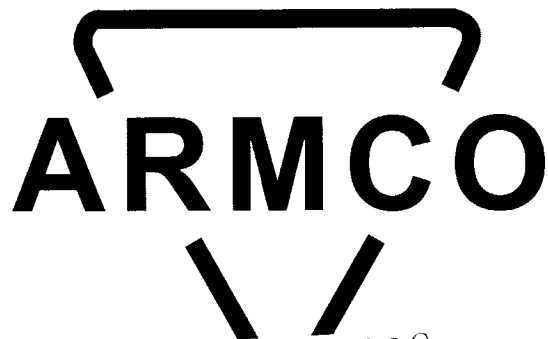


# **RCRA Facility Investigation Report Armco Kansas City Facility**

**Volume II  
Chapters 10.0 through 26.0**

**September 14, 1999  
Project 94-498-4-008-00/01**

**Prepared by  
Burns & McDonnell Waste Consultants, Inc.  
Engineers-Geologists-Consultants  
Kansas City, Missouri**



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**ARMCO KANSAS CITY FACILITY**

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## LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AST	Aboveground Storage Tank
atm-m <sup>3</sup> /mol	Atmospheres-cubic meters/mole
ATSDR	Agency for Toxic Substances and Disease Registry
BEHP	Bis(2-ethylhexyl)phthalate
bgs	Below ground surface
BMcD	Burns & McDonnell
BMWCI	Burns & McDonnell Waste Consultants, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CEC	Cation Exchange Capacity
cfs	Cubic feet per second
CH	Clay
cis-1,2-DCE	cis-1,2-Dichloroethene
CL	Silty or sandy clay
cm	Centimeter
COE	Corp of Engineers
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
Cr	Chromium
DAF	Dilution Attenuation Factor
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCE	1,2-Dichloroethene
EP-Toxicity	Extraction Procedure for Toxicity
Facility	Armco Kansas City, Missouri Facility
°F	Degrees Fahrenheit
ft	Feet
GC	Clayey gravel (soil reference)
GC	Gas chromatography (analytical reference)
GM	Silty gravel
GST	GS Technologies Corporation
HHRA	Human Health Risk Assessment
HSWA	Hazardous and Solid Waste Amendments
I-435	Interstate Highway 435
IM	Interim Measures
IMP	<i>Interim Measures Plan for the Armco Kansas City Facility</i>
K	Hydraulic conductivity
KCT	Kansas City Terminal Railway Company
K <sub>d</sub>	Adsorption coefficient
Kg	Kilogram
K <sub>oc</sub>	Organic Carbon-Water Partitioning Coefficient
K <sub>ow</sub>	Octanol-Water Partitioning Coefficient
L	Liter
MCL	Maximum Contaminant Level
MDNR	Missouri Department of Natural Resources
mg	Milligram

## LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

ML	Silt, clayey silt
mmHg	Millimeters of mercury
MSL	Mean Sea Level
nm	Nanometers
NPDES	National Pollution Discharge Elimination System
PAH	Polynuclear Aromatic Hydrocarbon
PCE	Tetrachloroethene
Permit	Armco's Part B Post-Closure Permit
PID	Photoionization Detector
ppm	Parts per million
PSI	Pollutant Standards Index
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RCRA Landfill	Closed Emission Control Dust Landfill
redox	Reduction/oxidation
Revised IMP	<i>Revised Interim Measures Plan for the Armco Kansas City Facility</i>
RFI	Resource Conservation and Recovery Act (RCRA) Facility Investigation
RFI Workplan	<i>RCRA Facility Investigation Workplan for the Armco Kansas City Facility</i>
SC	Clayey sand
sec	Second
SESOIL	Seasonal Soil Compartment Model
SM	Silty sand
Sq. mi.	Square mile
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
trans-1,2-DCE	trans-1,2-Dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
µg	Microgram
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UTL	Upper Tolerance Limit
UV	Ultraviolet
VOC	Volatile Organic Compound
WCC	Woodward Clyde Consultants
XRF	X-Ray Fluorescence

**SWMU 7**  
**NO. 1 MELT SHOP BAGHOUSE DUST TANKS**  
**(ARMCO PROPERTY)**

## **10.0 SWMU 7 – NO. 1 MELT SHOP BAGHOUSE DUST TANKS**

### **10.1 SWMU BACKGROUND**

#### **10.1.1 Description of SWMU**

The No. 1 Melt Shop Baghouse Dust Tanks (SWMU 7), located on Armco property (see Figure 1-2), was constructed in 1962 to contain emission control dust generated by the electric arc furnaces at the No. 1 Melt Shop. The SWMU consisted of two steel tanks approximately 10 feet in diameter and 25.5 feet tall with a total storage capacity of approximately 75 cubic yards. Emission control dust from the No. 1 Melt Shop baghouse was transferred into these tanks for temporary storage.

For a short time in the mid-1980s, experimentation was conducted to determine if it was feasible for the emission control dust to be pelletized and reintroduced into the electric arc furnaces. During the remainder of the operational life of the SWMU, the emission control dust stored in the tanks was subsequently transferred by truck to a number of other on-site SWMUs for management.

Operations at this SWMU continued until 1988 when the No. 1 Melt Shop was removed from service. Prior to their demolition in 1991, the tanks were cleaned by a remediation contractor, and emission control dust was removed from dust handling equipment. No evidence of SWMU 7 remains. The original defined SWMU area was approximately 50 feet by 25 feet (less than 0.05 acres) in size.

Based on the types of materials handled at SWMU 7, the primary constituents of potential concern were lead and cadmium associated with emission control dust.

### **10.1.2 Release Potential**

A spill of approximately 15 cubic yards that occurred on March 26, 1988 was reported. No other documented spills are known to have occurred at this location.

The primary release potential for this SWMU was to the surrounding surface soils. The potential for release was minimized since transfer activities were controlled and supervised. In addition, the majority of the area around the rail lines where transfers occurred was covered with pavement.

## **10.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of soil samples. Table 10-1 presents a summary of the investigation activities for SWMU 7, and Figure 10-1 presents the sampling locations.

Six surface soil samples were collected at two depth intervals (0 to 0.5 and 0.5 to 1 feet bgs) from three grids (Grid 07G01 through 07G03) during RFI Phase 1. Each sample was a composite of five aliquots collected across the sampling grid. Based on the results from the surface soil grid samples, soil boring samples were also collected during RFI Phase 1 from eight locations (07B01 through 07B08) around the perimeter of these grids. One to two samples were collected from each soil boring, and the maximum depth interval sampled was 3 to 4 feet bgs. All samples were analyzed for lead and cadmium.

During RFI Phase 2, XRF screening was used to aid in characterization of soil samples (both surface and subsurface soil) in the field to more thoroughly define the extent of lead. Once the XRF screening indicated that the extent of lead had been defined, samples were sent to the analytical laboratory for confirmatory analysis. Selected samples from impacted areas were also sent to the analytical laboratory for confirmatory analysis and to assist in the definition of the vertical extent of cadmium and lead.

Samples were collected from 31 direct-push soil borings (07B04A, 07B09 through 07B37, and 07B32A) to the south and west of SWMU 7 during RFI Phase 2. Between two to eight subsurface soil samples were collected from each boring, for a total of 110 samples. All samples were initially screened in the field for lead using XRF spectroscopy, and 60 of the samples were subsequently sent to the analytical laboratory for confirmatory analysis of cadmium and lead. In addition, the samples collected from Borings 07B32 and 07B32A were also analyzed for pH to obtain soil chemistry information.

To further define the extent of lead and cadmium in the soil, eighteen test pits (07TP01 through 07TP18) were placed to the west and south of SWMU 7. Test pits were installed rather than direct-push borings because of the frequent occurrence of direct-push refusal due to compacted slag fill. Seven samples were taken from each pit in one foot depth intervals that ranged from 0 to 7 feet bgs. Test Pit 07TP02 and 07TP03 were exceptions, and had only two and six samples, respectively, collected. A total of 120 soil samples were collected from the test pits. The soil samples were analyzed for cadmium and lead by the analytical laboratory.

SWMU 7 is directly underlain by gravel sized slag and refractory brick fragments in a silty to sandy clay matrix. The fill material ranged in thickness from 2.0 feet to greater than 7.0 feet in the direct-push borings and trenches completed during the RFI. The underlying silty clay was typical of the Blue River alluvium observed elsewhere at the Facility. Test Pits were utilized at SWMU 7 during the latter part of the investigation due to frequent refusal of direct-push boring equipment in the slag fill. Perched groundwater was not encountered.

### **10.3 NATURE AND EXTENT OF METALS CONTAMINATION IN SOIL**

Tables 10-2 through 10-4 summarize the analytical results for SWMU 7. Figure 10-2 presents the cadmium and lead analytical results for SWMU 7. XRF data is presented in Appendix S.

Samples from Borings 07B32 and 07B32A were analyzed for pH. Values ranged from a low pH 9.1 J\* in the uppermost interval at 07B32, to pH 11.5 J\* in the deepest interval at 07B32A.



Cadmium was detected in 154 of the 198 surface soil and subsurface soil samples. The number of detections, exceedences, and highest cadmium concentrations are summarized in the table below by depth interval.

Cadmium Results for SWMU 7 by Depth							
Depth (ft)	Number of Samples	Number of Detections	Number of 20 DAF SSL Exceedences	Highest Detection (mg/Kg)	Location	Second Highest Detection (mg/Kg)	Location
0-1	37	33	14	148	07TP17	40 D	07B15
1-2	42	39	12	210	07TP17	121 DJ*	07B32
2-3	34	22	6	281 DJ*	07B32	125	07B37
3-4	28	18	3	70.3 J*	07TP07	55	07TP17
4-5	20	18	2	170	07TP17	15.7 DJ*	07B32A
5-6	19	12	2	221	07TP17	9.1 J*	07TP13
6-7	17	12	2	83.3	07TP17	10.9 J*	07TP10
7-8	1	0	0				

Lead was detected in all of the 198 surface soil and subsurface soil samples. The number of detections, exceedences, and highest lead concentration are summarized in the table below by depth interval.

Lead Results for SWMU 7 by Depth							
Depth (ft)	Number of Samples	Number of Detections	Number of 20 DAF SSL Exceedences	Highest Detection (mg/Kg)	Location	Second Highest Detection (mg/Kg)	Location
0-1	37	37	15	4500 J*	07TP17	2570 DJ*	07B32
1-2	42	42	16	6990 J*	07TP17	2620 DJ*	07B32
2-3	34	34	7	14300 J*	07B37	8530 DJ*	07B32
3-4	28	28	4	7930 J*	07TP07	1930 J*	07TP17
4-5	20	20	4	4790 J*	07TP17	1720 DJ*	07B32A
5-6	19	19	3	7980 J*	07TP17	691	07TP13
6-7	17	17	2	2530 J*	07TP17	532	07TP13
7-8	1	1	0	11.9 J*	07B36		

Cadmium and lead concentrations were below the 20 DAF SSLs for approximately 75 to 80 percent of the samples collected. Cadmium concentrations exceeded the 20 DAF SSL (8 mg/Kg) in 41 of the 198 samples, and lead concentrations exceeded the 20 DAF SSL (400 mg/Kg) in 51

of the 198 samples. These exceedences are summarized in Table 10-5. As shown on Figure 10-2, the size of the SWMU 7 area increased in size during the investigation (to approximately 2 acres) to the west and south of the former No. 1 Melt Shop Baghouse Dust Tank in order to define the nature and extent of contamination.

Most of the highest concentrations of cadmium and lead were found in samples collected from Test Pit 07TP17 and Boring 07B32/32A which were both located southwest of the No. 1 Melt Shop. At these locations, cadmium concentrations ranged up to 281 DJ\* mg/Kg, and lead concentrations ranged up to 8,530 DJ\* mg/Kg. In this same area, Boring 07B37 contained elevated concentrations of cadmium and lead in the sample collected from 2 to 3 feet bgs (125 mg/Kg and 14,300 mg/Kg, respectively). However, as shown on Figure 10-2, locations exceeding screening levels occurred throughout the entire area sampled. In the eastern portion of the area, the extent of contamination was defined by Boring 07B23. In general, the southern and western extents of contamination were defined by either boring or test pit samples, or by the physical restriction of the Blue River. Along the northern portion of the area sampled, the extent of contamination was defined by either the foundation of the No. 1 Melt Shop or by samples from Test Pits 07TP01 through 07TP06 (located in the northwestern portion of the area sampled).

The vertical extent of cadmium and lead was adequately defined throughout the majority of this area. Most of the contamination was limited to the upper 4 feet of soil or less, and concentrations decreased below the 20 DAF SSLs in deeper samples. However, a small area near Test Pits 07TP17 and 07TP13 contained exceedences of the 20 DAF SSLs for both cadmium and lead in the deepest interval sampled (6 to 7 feet bgs).

#### **10.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 7, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and the air pathway (airborne dust).

The nature and extent of contamination at SWMU 7 was assessed through the collection of surface and subsurface soil samples. Lead and cadmium concentrations in soil throughout SWMU 7 exceeded 20 DAF SSLs (based on soil migration to groundwater) to depths of 3 feet bgs. However, a few locations contained exceedences as deep as 7 feet bgs (approximate deepest elevation 740 feet above MSL). Based on the data, soil transfer to groundwater could occur. The tendency for metals to strongly adsorb to soil and the basic soil pH values (9.1 to 11.5) at SWMU 7 should limit the potential for metals to migrate vertically in soil.

Groundwater was not encountered during subsurface soil sampling at SWMU 7 and groundwater samples were not collected. Based on groundwater information from AOC 1 (located just north of SWMU 7), the saturated zone is typically encountered at approximate elevations ranging from 737 to 738 feet above MSL. Based on the limited areas of metals soil contamination at depths to 7 feet bgs (approximate deepest elevation 740 feet above MSL) and the tendencies for metals to strongly adsorb to soil rather than migrate with groundwater movement, the groundwater transport pathway is not expected to be significant for SWMU 7.

Surface cover material at SWMU 7 is primarily slag fill. Storm water runs directly to the Blue River in the western- and southern-most portions of SWMU 7 or to storm drains in the SWMU area. Storm sewers discharge to the Blue River. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, and airborne dust transport are potential routes for contaminant migration at SWMU 7.

## **10.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 7.

### **10.5.1 Human Health Evaluation**

Cadmium and lead were identified as COPCs in both surface and subsurface soil. A HHRA and lead modeling were conducted for SWMU 7 to evaluate potential health risks to possible future

on-site work populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in soil at SWMU 7. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.

### **10.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 7. Therefore, and ecological risk evaluation was not conducted for SWMU 7.

## **10.6 SUMMARY**

SWMU 7, located in the western portion of the Facility, was two former tanks utilized for temporary storage of emission control dust. The original defined SWMU area was approximately 50 feet by 25 feet (less than 0.05 acres) in size. The SWMU 7 area was expanded in size during the investigation (to approximately 2 acres) to the west and south of the former No. 1 Melt Shop Baghouse Dust Tank in order to define the nature and extent of contamination. Surface soil and subsurface soil samples were collected at SWMU 7. A total of 198 surface soil and subsurface soil samples were collected from cadmium and lead analyses, and 6 subsurface soil samples were analyzed for soil pH.

Figure 10-2 summarizes the extent of cadmium and lead in soil at SWMU 7. Cadmium and lead were detected at concentrations exceeding 20 DAF SSLs throughout the sampling area (highest concentrations 281 DJ\* and 14,300J\* mg/Kg, respectively). In many locations, samples were collected until physical restrictions were reached (i.e. No. 1 Melt Shop foundation to the north and Blue River to the south). The horizontal extent of cadmium and lead was defined by Boring 07B23 to the east. Along the north, south, and west, the horizontal extent was defined by either sampling locations (Test Pits 07TP01 through 07TP06 to the west) or physical restrictions (No. 1 Melt Shop on the north and the Blue River on the south). The majority of the cadmium and lead

contamination was limited to the upper 4 feet of soil. Soil pH values were slightly basic to basic (pH 9.1 J\* to 11.5 J\*).

Potential migration pathways at SWMU 7 include soil transfer to groundwater, groundwater transport, storm water runoff, surface water transport, and airborne dust migration. Soil detections of cadmium and lead exceeded 20 DAF SSLs (based on soil migration to groundwater) thus indicating that soil transfer to groundwater could occur. The tendency for metals to strongly adsorb to soil and the basic pH of the soil at SWMU 7 are expected to limit vertical migration of metals in soil. Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Groundwater transport is not expected to be a significant migration pathway for SWMU 7.

Storm water runs directly to the Blue River in the western- and southern-most portions of SWMU 7 or to storm drains/storm sewers in the SWMU area that discharge to the Blue River. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, and airborne dust transport are potential routes for contaminant migration at SWMU 7.

A risk evaluation was conducted for SWMU 7. For the human health evaluation, cadmium and lead were identified as COPCs in surface and subsurface soil. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil at SWMU 7 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 7.

\* \* \* \* \*

**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis			Comments	Lab ID Number
Point	Designator					Total		pH		
						Lead	Cadmium			
COMPOSITE SURFACE SOIL GRIDS										
07G01	SR1	0 - 0.5	03/11/1997	1		X	X		Field Duplicate	D97-2928-1
	SR2	0.5 - 1.0	03/11/1997	1		X	X			D97-2928-2
	SR2D	0.5 - 1.0	03/11/1997	1		X	X			D97-2928-3
07G02	SR1	0 - 0.5	03/11/1997	1		X	X		Matrix Spike Matrix Spike Duplicate	D97-2928-4
	SR1MS	0 - 0.5	03/11/1997	1		X	X			D97-2928-5
	SR1MSD	0 - 0.5	03/11/1997	1		X	X			D97-2928-6
	SR2	0.5 - 1.0	03/11/1997	1		X	X			D97-2928-7
07G03	SR1	0 - 0.5	03/11/1997	1		X	X		Rinsate	D97-2928-8
	SR2	0.5 - 1.0	03/11/1997	1		X	X			D97-2928-9
	SR2R		03/11/1997	1		X	X			D97-2928-10
DIRECT-PUSH SUBSURFACE SOIL SAMPLES										
07B01	DP1	1 - 2	04/22/1997	1		X	X			D97-4913-4
	DP2	3 - 4	04/22/1997	1		X	X			D97-4913-5
07B02	DP1	2 - 3	04/22/1997	1		X	X			D97-4913-6
07B03	DP1	1 - 2	04/22/1997	1		X	X			D97-4913-7
07B04	DP1	1.5 - 2.5	04/22/1997	1		X	X			D97-4913-8
07B04A	DP2	3 - 4	05/28/1998	2	X	X	X			D98-4020-7
07B05	DP1	0.5 - 1.5	04/22/1997	1		X	X			D97-4913-9
	DP2	2.5 - 3.5	04/22/1997	1		X	X			D97-4913-10
07B06	DP1	0.5 - 1.0	04/22/1997	1		X	X			D97-4913-11
	DP2	1.5 - 2.5	04/22/1997	1		X	X			D97-4913-12
07B07	DP1	0.0 - 1.0	04/22/1997	1		X	X			D97-4913-13
	DP2	1.5 - 2.5	04/22/1997	1		X	X			D97-4913-14
07B08	DP1	0.0 - 1.0	04/22/1997	1		X	X			D97-4913-15
07B09	DP1	0 - 1	05/28/1998	2	X					D98-4020-8
	DP2	1 - 2	05/28/1998	2	X					
	DP3	2 - 3	05/28/1998	2	X					
	DP4	3 - 4	05/28/1998	2	X	X	X			
07B10	DP1	0 - 1	05/28/1998	2	X					
	DP2	1 - 2	05/28/1998	2	X					
	DP3	2 - 3	05/28/1998	2	X					
07B11	DP2	1 - 2	05/28/1998	2	X	X	X			D98-4020-9
	DP3	2 - 3	05/28/1998	2	X	X	X			D98-4020-10
	DP4	3 - 4	05/28/1998	2	X					
07B12	DP1	0 - 1	06/01/1998	2	X	X	X			D98-4323-1
	DP2	1 - 2	06/01/1998	2	X	X	X			D98-4323-2
	DP3	2 - 3	06/01/1998	2	X	X	X			D98-4323-3
	DP4	3 - 4	06/01/1998	2	X	X	X			D98-4323-4
07B13	DP1	0 - 1	06/01/1998	2	X				Field Duplicate	
	DP2	1 - 2	06/01/1998	2	X					
	DP2D	1 - 2	06/01/1998	2	X					
	DP3	2 - 3	06/01/1998	2	X					
	DP4	3 - 4	06/01/1998	2	X					
07B14	DP1	0 - 1	06/01/1998	2	X					
	DP2	1 - 2	06/01/1998	2	X					
	DP3	2 - 3	06/01/1998	2	X					
07B15	DP1	0 - 1	06/01/1998	2	X	X	X		Matrix Spike Matrix Spike Duplicate	D98-4323-5
	DP2	1 - 2	06/01/1998	2	X	X	X			D98-4148-1
	DP2MS	1 - 2	06/01/1998	2	X	X	X			D98-4148-2
	DP2MSD	1 - 2	06/01/1998	2	X	X	X			D98-4148-3
	DP3	2 - 3	06/01/1998	2	X	X	X			D98-4323-6

**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis			Comments	Lab ID Number
Point	Designator					Total		pH		
						Lead	Cadmium			
07B16	DP1	0 - 1	06/01/1998	2	X				Field Duplicate	
	DP1D	0 - 1	06/01/1998	2	X					
	DP2	1 - 2	06/01/1998	2	X					
07B17	DP1	0 - 1	06/02/1998	2	X	X	X		Field Duplicate	D98-4323-7
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4323-8
	DP2D	1 - 2	06/02/1998	2	X	X	X			D98-4323-9
	DP3	2 - 3	06/02/1998	2	X	X	X			D98-4323-10
07B18	DP1	0 - 1	06/02/1998	2	X	X	X			D98-4323-11
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4323-12
	DP3	2 - 3	06/02/1998	2	X	X	X			D98-4323-13
	DP4	3 - 4	06/02/1998	2	X	X	X			D98-4323-14
07B19	DP1	0 - 1	06/02/1998	2	X	X	X			D98-4323-15
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4323-16
	DP3	2 - 3	06/02/1998	2	X	X	X			D98-4323-17
	DP4	3 - 4	06/02/1998	2	X	X	X			D98-4323-18
07B20	DP1	0 - 1	06/02/1998	2	X	X	X		Matrix Spike Matrix Spike Duplicate	D98-4148-4
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4148-5
	DP2MS	1 - 2	06/02/1998	2	X					
	DP2MSD	1 - 2	06/02/1998	2	X					
	DP3	2 - 3	06/02/1998	2	X	X	X			D98-4148-6
07B21	DP1	0 - 1	06/02/1998	2	X					
	DP2	1 - 2	06/02/1998	2	X					
	DP3	2 - 3	06/02/1998	2	X					
07B22	DP1	0 - 1	06/02/1998	2	X					
	DP2	1 - 2	06/02/1998	2	X					
07B23	DP1	0 - 1	06/02/1998	2	X	X	X			D98-4148-7
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4148-8
	DP3	2 - 3	06/02/1998	2	X					
07B24	DP1	0 - 1	06/02/1998	2	X	X	X		Matrix Spike Matrix Spike Duplicate	D98-4148-9
	DP1MS	0 - 1	06/02/1998	2	X					
	DP1MSD	0 - 1	06/02/1998	2	X					
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4148-10
07B25	DP1	0 - 1	06/02/1998	2	X					
	DP2	1 - 2	06/02/1998	2	X					
	DP3	2 - 3	06/02/1998	2	X					
07B26	DP1	0 - 1	06/02/1998	2	X	X	X		Field Duplicate	D98-4148-11
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4148-12
	DP3	2 - 3	06/02/1998	2	X	X	X			D98-4148-13
	DP3D	2 - 3	06/02/1998	2	X	X	X			D98-4148-14
	DP4	3 - 4	06/02/1998	2	X					
07B27	DP1	0 - 1	06/02/1998	2	X	X	X			D98-4323-19
	DP2	1 - 2	06/02/1998	2	X	X	X			D98-4323-20
07B28	DP1	0 - 1	06/05/1998	2	X				Matrix Spike Matrix Spike Duplicate	
	DP2	1 - 2	06/05/1998	2	X					
	DP2MS	1 - 2	06/05/1998	2	X					
	DP2MSD	1 - 2	06/05/1998	2	X					
	DP3	2 - 3	06/05/1998	2	X					
	DP4	3 - 4	06/05/1998	2	X					
	DP5	4 - 5	06/05/1998	2	X					

**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis			Comments	Lab ID Number
Point	Designator					Total		pH		
						Lead	Cadmium			
07B29	DP1	0 - 1	06/05/1998	2	X					
	DP2	1 - 2	06/05/1998	2	X					
	DP3	2 - 3	06/05/1998	2	X					
	DP4	3 - 4	06/05/1998	2	X					
	DP5	4 - 5	06/05/1998	2	X					
	DP6	5 - 6	06/05/1998	2	X					
	DP7	6 - 7	06/05/1998	2	X					
07B30	DP1	0 - 1	06/05/1998	2	X	X	X			D98-4323-21
	DP2	1 - 2	06/05/1998	2	X	X	X			D98-4323-22
	DP3	2 - 3	06/05/1998	2	X					
	DP4	3 - 4	06/05/1998	2	X	X	X			D98-4323-23
	DP4D	3 - 4	06/05/1998	2	X	X	X		Field Duplicate	D98-4323-24
	DP5	4 - 5	06/05/1998	2	X					
	DP6	5 - 6	06/05/1998	2	X					
	DP7	6 - 7	06/05/1998	2	X					
07B31	DP2	1 - 2	06/10/1998	2	X	X	X			D98-4234-8
	DP3	2 - 3	06/10/1998	2	X	X	X			D98-4234-9
	DP5	4 - 5	06/10/1998	2	X	X	X			D98-4234-7
	DP6	5 - 6	06/10/1998	2	X					
	DP7	6 - 7	06/10/1998	2	X					
07B32	DP1	0 - 1	06/10/1998	2	X	X	X	X		D98-4234-4
	DP2	1 - 2	06/10/1998	2	X	X	X	X		D98-4234-5
	DP3	2 - 3	06/10/1998	2	X	X	X	X		D98-4234-6
07B32A	DP4	3 - 4	06/10/1998	2	X	X	X	X		D98-4234-10
	DP5	4 - 5	06/10/1998	2	X	X	X	X		D98-4234-11
	DP5MS	4 - 5	06/10/1998	2	X	X	X		Matrix Spike	D98-4234-12
	DP5MSD	4 - 5	06/10/1998	2	X	X	X		Matrix Spike Duplicate	D98-4234-13
	DP6	5 - 6	06/10/1998	2	X	X	X	X		D98-4234-14
07B33	DP1	0 - 1	06/10/1998	2	X	X	X			D98-4234-1
	DP2	1 - 2	06/10/1998	2	X	X	X			D98-4234-2
	DP3	2 - 3	06/10/1998	2	X	X	X			D98-4234-3
07B34	DP1	0 - 1	06/10/1998	2	X					
	DP2	1 - 2	06/10/1998	2	X					
07B35	DP1	0 - 1	06/10/1998	2	X					
	DP1R	0 - 1	06/10/1998	2		X	X		Rinsate	D98-4234-15
	DP2	1 - 2	06/10/1998	2	X					
	DP2D	1 - 2	06/10/1998	2	X				Field Duplicate	
	DP3	2 - 3	06/10/1998	2	X					
07B36	DP2	1 - 2	08/24/1998	2		X	X			363802
	DP3	2 - 3	08/24/1998	2		X	X			363803
	DP4	3 - 4	08/24/1998	2		X	X			363804
	DP5	4 - 5	08/24/1998	2		X	X			363805
	DP6	5 - 6	08/24/1998	2		X	X			363806
	DP7	6 - 7	08/24/1998	2		X	X			363807
	DP8	7 - 8	08/24/1998	2		X	X			363808
	DP8MS	7 - 8	08/24/1998	2		X	X		Matrix Spike	363808MS
	DP8MSD	7 - 8	08/24/1998	2		X	X		Matrix Spike Duplicate	363808DP
	DP8R	7 - 8	08/24/1998	2		X	X		Rinsate	363814



**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis			Comments	Lab ID Number
Point	Designator					Total		pH		
						Lead	Cadmium			
07B37	DP1	0 - 1	08/24/1998	2		X	X			363809
	DP2	1 - 2	08/24/1998	2		X	X			363810
	DP3	2 - 3	08/24/1998	2		X	X			363811
	DP4	3 - 4	08/24/1998	2		X	X			363812
	DP4D	3 - 4	08/24/1998	2		X	X		Field Duplicate	363813
TEST PIT SOIL SAMPLES										
07TP01	SB1	0 - 1	09/16/1998	2		X	X			366189
	SB2	1 - 2	09/16/1998	2		X	X			366190
	SB3	2 - 3	09/16/1998	2		X	X			366191
	SB4	3 - 4	09/16/1998	2		X	X			366192
	SB5	4 - 5	09/16/1998	2		X	X			366193
	SB6	5 - 6	09/16/1998	2		X	X			366194
	SB7	6 - 7	09/16/1998	2		X	X			366195
07TP02	SB1	0 - 1	09/16/1998	2		X	X			366196
	SB2	1 - 2	09/16/1998	2		X	X			366197
07TP03	SB1	0 - 1	09/16/1998	2		X	X			366198
	SB2	1 - 2	09/16/1998	2		X	X			366199
	SB3	2 - 3	09/16/1998	2		X	X			366200
	SB3D	2 - 3	09/16/1998	2		X	X		Field Duplicate Matrix Spike Matrix Spike Duplicate	366223
	SB3MS	2 - 3	09/16/1998	2		X	X			366200MS
	SB3MSD	2 - 3	09/16/1998	2		X	X			366200DP
	SB4	3 - 4	09/16/1998	2		X	X			366224
	SB5	4 - 5	09/16/1998	2		X	X			366225
SB6	5 - 6	09/16/1998	2		X	X			366226	
07TP04	SB1	0 - 1	09/16/1998	2		X	X			366227
	SB2	1 - 2	09/16/1998	2		X	X			366228
	SB3	2 - 3	09/16/1998	2		X	X			366229
	SB4	3 - 4	09/16/1998	2		X	X			366230
	SB5	4 - 5	09/16/1998	2		X	X			366231
	SB6	5 - 6	09/16/1998	2		X	X			366232
	SB7	6 - 7	09/16/1998	2		X	X			366233
07TP05	SB1	0 - 1	09/16/1998	2		X	X			366234
	SB2	1 - 2	09/16/1998	2		X	X			366235
	SB3	2 - 3	09/16/1998	2		X	X			366236
	SB4	3 - 4	09/16/1998	2		X	X			366237
	SB5	4 - 5	09/16/1998	2		X	X			366238
	SB6	5 - 6	09/16/1998	2		X	X			366239
	SB7	6 - 7	09/16/1998	2		X	X			366240
07TP06	SB1	0 - 1	09/16/1998	2		X	X			366241
	SB1D	0 - 1	09/16/1998	2		X	X		Field Duplicate Matrix Spike Matrix Spike Duplicate	366242
	SB1MS	0 - 1	09/16/1998	2		X	X			366241MS
	SB1MSD	0 - 1	09/16/1998	2		X	X			366241DP
	SB2	1 - 2	09/16/1998	2		X	X			366381
	SB3	2 - 3	09/16/1998	2		X	X			366382
	SB4	3 - 4	09/16/1998	2		X	X			366383
	SB5	4 - 5	09/16/1998	2		X	X			366384
	SB6	5 - 6	09/16/1998	2		X	X			366385
SB7	6 - 7	09/16/1998	2		X	X			366386	

**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis			Comments	Lab ID Number
Point	Designator					Total		pH		
						Lead	Cadmium			
07TP07	SB1	0 - 1	09/16/1998	2		X	X			366387
	SB2	1 - 2	09/16/1998	2		X	X			366388
	SB3	2 - 3	09/16/1998	2		X	X			366389
	SB4	3 - 4	09/16/1998	2		X	X			366390
	SB5	4 - 5	09/16/1998	2		X	X			366391
	SB6	5 - 6	09/16/1998	2		X	X			366392
	SB7	6 - 7	09/16/1998	2		X	X			366393
07TP08	SB1	0 - 1	09/17/1998	2		X	X			366407
	SB2	1 - 2	09/17/1998	2		X	X			366408
	SB3	2 - 3	09/17/1998	2		X	X			366409
	SB4	3 - 4	09/17/1998	2		X	X			366410
	SB5	4 - 5	09/17/1998	2		X	X			366411
	SB6	5 - 6	09/17/1998	2		X	X			366412
	SB7	6 - 7	09/17/1998	2		X	X			366421
07TP09	SB1	0 - 1	09/17/1998	2		X	X		Field Duplicate Matrix Spike Matrix Spike Duplicate	366422
	SB2	1 - 2	09/17/1998	2		X	X			366413
	SB2D	1 - 2	09/17/1998	2		X	X			366428
	SB2MS	1 - 2	09/17/1998	2		X	X			366413MS
	SB2MSD	1 - 2	09/17/1998	2		X	X			366413DP
	SB3	2 - 3	09/17/1998	2		X	X			366423
	SB4	3 - 4	09/17/1998	2		X	X			366424
	SB5	4 - 5	09/17/1998	2		X	X			366425
	SB6	5 - 6	09/17/1998	2		X	X			366426
SB7	6 - 7	09/17/1998	2		X	X		366427		
07TP10	SB1	0 - 1	09/17/1998	2		X	X			366429
	SB2	1 - 2	09/17/1998	2		X	X			366430
	SB3	2 - 3	09/17/1998	2		X	X			366431
	SB4	3 - 4	09/17/1998	2		X	X			366432
	SB5	4 - 5	09/17/1998	2		X	X			366433
	SB6	5 - 6	09/17/1998	2		X	X			366434
	SB7	6 - 7	09/17/1998	2		X	X			366435
07TP11	SB1	0 - 1	09/17/1998	2		X	X			366436
	SB2	1 - 2	09/17/1998	2		X	X			366437
	SB3	2 - 3	09/17/1998	2		X	X			366438
	SB4	3 - 4	09/17/1998	2		X	X			366439
	SB5	4 - 5	09/17/1998	2		X	X			366440
	SB6	5 - 6	09/17/1998	2		X	X			366451
	SB7	6 - 7	09/17/1998	2		X	X			366452
07TP12	SB1	0 - 1	09/17/1998	2		X	X		Field Duplicate Matrix Spike Matrix Spike Duplicate	366453
	SB2	1 - 2	09/17/1998	2		X	X			366454
	SB3	2 - 3	09/17/1998	2		X	X			366455
	SB4	3 - 4	09/17/1998	2		X	X			366456
	SB4D	3 - 4	09/17/1998	2		X	X			366457
	SB4MS	3 - 4	09/17/1998	2		X	X			366456MS
	SB4MSD	3 - 4	09/17/1998	2		X	X			366456DP
	SB5	4 - 5	09/17/1998	2		X	X			366458
	SB6	5 - 6	09/17/1998	2		X	X			366459
	SB7	6 - 7	09/17/1998	2		X	X			366460

**Table 10-1**  
**SWMU 7 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis		pH	Comments	Lab ID Number
Point	Designator					Total				
						Lead	Cadmium			
07TP13	SB1	0 - 1	09/17/1998	2		X	X			366461
	SB2	1 - 2	09/17/1998	2		X	X			366462
	SB3	2 - 3	09/17/1998	2		X	X			366463
	SB4	3 - 4	09/17/1998	2		X	X			366464
	SB5	4 - 5	09/17/1998	2		X	X			366465
	SB6	5 - 6	09/17/1998	2		X	X			366466
	SB7	6 - 7	09/17/1998	2		X	X			366467
07TP14	SB1	0 - 1	09/17/1998	2		X	X			366468
	SB2	1 - 2	09/17/1998	2		X	X			366469
	SB3	2 - 3	09/17/1998	2		X	X			366470
	SB4	3 - 4	09/17/1998	2		X	X			366471
	SB5	4 - 5	09/17/1998	2		X	X			366472
	SB6	5 - 6	09/17/1998	2		X	X			366473
	SB7	6 - 7	09/17/1998	2		X	X			366474
07TP15	SB1	0 - 1	09/17/1998	2		X	X			366519
	SB2	1 - 2	09/17/1998	2		X	X			366520
	SB3	2 - 3	09/17/1998	2		X	X			366521
	SB4	3 - 4	09/17/1998	2		X	X			366522
	SB5	4 - 5	09/17/1998	2		X	X			366523
	SB5D	4 - 5	09/17/1998	2		X	X		Field Duplicate	366524
	SB5MS	4 - 5	09/17/1998	2		X	X		Matrix Spike	366523MS
	SB5MSD	4 - 5	09/17/1998	2		X	X		Matrix Spike Duplicate	366523DP
	SB6	5 - 6	09/17/1998	2		X	X			366525
SB7	6 - 7	09/17/1998	2		X	X			366526	
07TP16	SB1	0 - 1	09/17/1998	2		X	X			366490
	SB2	1 - 2	09/17/1998	2		X	X			366513
	SB3	2 - 3	09/17/1998	2		X	X			366514
	SB4	3 - 4	09/17/1998	2		X	X			366515
	SB5	4 - 5	09/17/1998	2		X	X			366516
	SB6	5 - 6	09/17/1998	2		X	X			366517
	SB7	6 - 7	09/17/1998	2		X	X			366518
07TP17	SB1	0 - 1	09/17/1998	2		X	X			366483
	SB2	1 - 2	09/17/1998	2		X	X			366484
	SB3	2 - 3	09/17/1998	2		X	X			366485
	SB4	3 - 4	09/17/1998	2		X	X			366486
	SB5	4 - 5	09/17/1998	2		X	X			366487
	SB6	5 - 6	09/17/1998	2		X	X			366488
	SB7	6 - 7	09/17/1998	2		X	X			366489
07TP18	SB1	0 - 1	09/17/1998	2		X	X			366475
	SB2	1 - 2	09/17/1998	2		X	X			366476
	SB3	2 - 3	09/17/1998	2		X	X			366477
	SB4	3 - 4	09/17/1998	2		X	X			366478
	SB5	4 - 5	09/17/1998	2		X	X			366479
	SB6	5 - 6	09/17/1998	2		X	X			366480
	SB6D	5 - 6	09/17/1998	2		X	X		Field Duplicate	366481
	SB6MS	5 - 6	09/17/1998	2		X	X		Matrix Spike	366480MS
	SB6MSD	5 - 6	09/17/1998	2		X	X		Matrix Spike Duplicate	366480DP
SB7	6 - 7	09/17/1998	2		X	X			366482	

Notes:

ft = feet

XRF = X-Ray Fluorescence Spectroscopy

**Table 10-2**  
**SWMU 7 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07G01/SR1	07G01/SR2	07G01/SR2D	07G02/SR1	07G02/SR2	07G03/SR1	07G03/SR2
Date Sampled:		03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997
Sample Depth From:		0	0.5	0.5	0	0.5	0	0.5
Sample Depth To:		0.5	1	1	0.5	1	0.5	1
Laboratory Number:		D97-2928-1	D97-2928-2	D97-2928-3	D97-2928-4	D97-2928-7	D97-2928-8	D97-2928-9
Sample Type:				Duplicate				
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	1.53 J	4.4 J*	2.96 J*	11.9 J*	24.4 J*	37 J*	56 J*
Lead, Total	mg/Kg	78.5	199	133	491	1,030	1,400	2,010

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinseate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		07B01/DP1 04/22/1997 1 2 D97-4913-4	07B01/DP2 04/22/1997 3 4 D97-4913-5	07B02/DP1 04/22/1997 2 3 D97-4913-6	07B03/DP1 04/22/1997 1 2 D97-4913-7	07B04/DP1 04/22/1997 1.5 2.5 D97-4913-8	07B04A/DP2 05/28/1998 3 4 D98-4020-7	07B05/DP1 04/22/1997 0.5 1.5 D97-4913-9
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	22.7 J*	2.47 UJ*	2.43 UJ*	3.39 J*	19.1 J*	4.98 J*	2.88 J*
Lead, Total	mg/Kg	1,000 J*	11.7 J	10.5 J	134 J*	782 J*	164 J*	126 J*
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B05/DP2	07B06/DP1	07B06/DP2	07B07/DP1	07B07/DP2	07B08/DP1	07B09/DP4
Date Sampled:		04/22/1997	04/22/1997	04/22/1997	04/22/1997	04/22/1997	04/22/1997	05/28/1998
Sample Depth From:		2.5	0.5	1.5	0	1.5	0	3
Sample Depth To:		3.5	1	2.5	1	2.5	1	4
Laboratory Number:		D97-4913-10	D97-4913-11	D97-4913-12	D97-4913-13	D97-4913-14	D97-4913-15	D98-4020-8
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	2.48 UJ*	5.9 J*	2.57 UJ*	9.77 J*	2.48 U	2.49 U	4.87
Lead, Total	mg/Kg	11.7 J	1,450 J*	23.4 J*	407 J*	25.8	13.5	206 J*
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B11/DP2	07B11/DP3	07B12/DP1	07B12/DP2	07B12/DP3	07B12/DP4	07B15/DP1
Date Sampled:		05/28/1998	05/28/1998	06/01/1998	06/01/1998	06/01/1998	06/01/1998	06/01/1998
Sample Depth From:		1	2	0	1	2	3	0
Sample Depth To:		2	3	1	2	3	4	1
Laboratory Number:		D98-4020-9	D98-4020-10	D98-4323-1	D98-4323-2	D98-4323-3	D98-4323-4	D98-4323-5
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	2.99	0.37 J	3.09 D	6.14 D	11.2 D	5.5 DU	40 D
Lead, Total	mg/Kg	108 J*	13.3 J*	258 D	258 D	1,440 D	352 D	2,220 D
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B15/DP2	07B15/DP3	07B17/DP1	07B17/DP2	07B17/DP2D	07B17/DP3	07B18/DP1
Date Sampled:		06/02/1998	06/01/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998
Sample Depth From:		1	2	0	1	1	2	0
Sample Depth To:		2	3	1	2	2	3	1
Laboratory Number:		D98-4148-1	D98-4323-6	D98-4323-7	D98-4323-8	D98-4323-9	D98-4323-10	D98-4323-11
Sample Type:						Duplicate		
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	27.3 D	5.5 DU	21.6 D	13.7 D	11.7 D	2.76 DU	29.5 D
Lead, Total	mg/Kg	1,540 D	113 D	957 D	2,540 D	625 D	95.2 D	1,140 D
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B18/DP2	07B18/DP3	07B18/DP4	07B19/DP1	07B19/DP2	07B19/DP3	07B19/DP4
Date Sampled:		06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998
Sample Depth From:		1	2	3	0	1	2	3
Sample Depth To:		2	3	4	1	2	3	4
Laboratory Number:		D98-4323-12	D98-4323-13	D98-4323-14	D98-4323-15	D98-4323-16	D98-4323-17	D98-4323-18
Sample Type:								
Metals, Total	UNITS							
Cadmium, Total	mg/Kg	2.39 DJ	1.55 DJ	3.14 DU	8.43	29 D	3.81	0.67
Lead, Total	mg/Kg	350 D	124 D	48.4 D	213	200 D	51.1	74.4
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B20/DP1	07B20/DP2	07B20/DP3	07B23/DP1	07B23/DP2	07B24/DP1	07B24/DP2
Date Sampled:		06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998	06/02/1998
Sample Depth From:		0	1	2	0	1	0	1
Sample Depth To:		1	2	3	1	2	1	2
Laboratory Number:		D98-4148-4	D98-4148-5	D98-4148-6	D98-4148-7	D98-4148-8	D98-4148-9	D98-4148-10
Sample Type:								
Metals, Total	UNITS							
Cadmium, Total	mg/Kg	5.17	5.02 D	2.89 DU	3.27 D	4.03 D	2.18 DJ	1.34 DJ
Lead, Total	mg/Kg	117	158 D	54.1 D	90.7 D	140 D	110 D	28.5 D
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		07B26/DP1 06/02/1998 0 1 D98-4148-11	07B26/DP2 06/02/1998 1 2 D98-4148-12	07B26/DP3 06/02/1998 2 3 D98-4148-13	07B26/DP3D 06/02/1998 2 3 D98-4148-14 Duplicate	07B27/DP1 06/02/1998 0 1 D98-4323-19	07B27/DP2 06/02/1998 1 2 D98-4323-20	07B30/DP1 06/05/1998 0 1 D98-4323-21
Metals, Total	UNITS							
Cadmium, Total	mg/Kg	2.34	2.01 DJ	0.59 U	0.25 J	17 D	5.7 D	3.11
Lead, Total	mg/Kg	22.6	41.8 D	12	10.7	952 D	366 D	108
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B30/DP2	07B30/DP4	07B30/DP4D	07B31/DP2	07B31/DP3	07B31/DP5	07B32/DP1
Date Sampled:		06/05/1998	06/05/1998	06/05/1998	06/10/1998	06/10/1998	06/10/1998	06/10/1998
Sample Depth From:		1	3	3	1	2	4	0
Sample Depth To:		2	4	4	2	3	5	1
Laboratory Number:		D98-4323-22	D98-4323-23	D98-4323-24	D98-4324-8	D98-4324-9	D98-4324-7	D98-4324-4
Sample Type:				Duplicate				
Metals, Total	UNITS							
Cadmium, Total	mg/Kg	2.01 DJ	0.63 U	0.62 U	18.5 DJ*	1.15 DJ	1.51 DJ	27 DJ*
Lead, Total	mg/Kg	92.3 D	13.1	12.4	895 DJ*	45.2 DJ*	82.5 DJ*	2,570 DJ*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	9.1 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B32/DP2	07B32/DP3	07B32A/DP4	07B32A/DP5	07B32A/DP6	07B33/DP1	07B33/DP2
Date Sampled:		06/10/1998	06/10/1998	06/10/1998	06/10/1998	06/10/1998	06/10/1998	06/10/1998
Sample Depth From:		1	2	3	4	5	0	1
Sample Depth To:		2	3	4	5	6	1	2
Laboratory Number:		D98-4324-5	D98-4324-6	D98-4324-10	D98-4324-11	D98-4324-14	D98-4324-1	D98-4324-2
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	121 DJ*	281 DJ*	41.6 J*	15.7 DJ*	2.8 DUJ*	9.05 DJ*	3.67 DJ*
Lead, Total	mg/Kg	2,620 DJ*	8,530 DJ*	1,400 J*	1,720 DJ*	451 DJ*	480 DJ*	188 DJ*
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	10.4 J*	11.4 J*	11 J*	11.3 J*	11.5 J*	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B33/DP3	07B36/DP2	07B36/DP3	07B36/DP4	07B36/DP5	07B36/DP6	07B36/DP7
Date Sampled:		06/10/1998	08/24/1998	08/24/1998	08/24/1998	08/24/1998	08/24/1998	08/24/1998
Sample Depth From:		2	1	2	3	4	5	6
Sample Depth To:		3	2	3	4	5	6	7
Laboratory Number:		D98-4324-3	363802	363803	363804	363805	363806	363807
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	2.6 DUJ*	4.6	0.15 BU*	0.08 U	4.4	0.08 U	0.1 U
Lead, Total	mg/Kg	93.6 DJ*	218 J*	75.6 J*	46.1 J*	315 J*	18.1 J*	10.7 J*
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinseate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-3**  
**SWMU 7 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07B36/DP8	07B37/DP1	07B37/DP2	07B37/DP3	07B37/DP4	07B37/DP4D
Date Sampled:		08/24/1998	08/24/1998	08/24/1998	08/24/1998	08/24/1998	08/24/1998
Sample Depth From:		7	0	1	2	3	3
Sample Depth To:		8	1	2	3	4	4
Laboratory Number:		363808	363809	363810	363811	363812	363813
Sample Type:							Duplicate
<b>Metals, Total</b>	<b>UNITS</b>						
Cadmium, Total	mg/Kg	0.1 U	8.6	1.5	125	0.07 U	0.08 U
Lead, Total	mg/Kg	11.9 J*	459 J*	161 J*	14,300 J*	98.4 J*	201 J*
<b>Physical Properties of Soil</b>	<b>UNITS</b>						
pH	SU	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP01/SB1	07TP01/SB2	07TP01/SB3	07TP01/SB4	07TP01/SB5	07TP01/SB6	07TP01/SB7
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		0	1	2	3	4	5	6
Sample Depth To:		1	2	3	4	5	6	7
Laboratory Number:		366189	366190	366191	366192	366193	366194	366195
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.04 U	0.03 U	0.04 U	0.03 U	0.99	5.8	2.2
Lead, Total	mg/Kg	127	140	146	81.4	141	271	230

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP02/SB1	07TP02/SB2	07TP03/SB1	07TP03/SB2	07TP03/SB3	07TP03/SB3D	07TP03/SB4
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		0	1	0	1	2	2	3
Sample Depth To:		1	2	1	2	3	3	4
Laboratory Number:		366196	366197	366198	366199	366200	366223	366224
Sample Type:							Duplicate	
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.03 U	2	2.9	1.8	4.1	2.2 J*	1.7 J*
Lead, Total	mg/Kg	128	183	280	223	275	183	131

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP03/SB5	07TP03/SB6	07TP04/SB1	07TP04/SB2	07TP04/SB3	07TP04/SB4	07TP04/SB5
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		4	5	0	1	2	3	4
Sample Depth To:		5	6	1	2	3	4	5
Laboratory Number:		366225	366226	366227	366228	366229	366230	366231
Sample Type:								
Metals, Total	UNITS							
Cadmium, Total	mg/Kg	2.5 J*	1.1 J*	4.8 J*	1.1 J*	1.5 J*	3.6 J*	0.45 BJ*
Lead, Total	mg/Kg	383	171	247	173	64.5	49	42.4

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP04/SB6	07TP04/SB7	07TP05/SB1	07TP05/SB2	07TP05/SB3	07TP05/SB4	07TP05/SB5
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		5	6	0	1	2	3	4
Sample Depth To:		6	7	1	2	3	4	5
Laboratory Number:		366232	366233	366234	366235	366236	366237	366238
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.11 U	0.09 U	19.2 J*	0.11 BJ*	0.08 U	0.47 BJ*	0.1 U
Lead, Total	mg/Kg	26.6	17.1	518	67	17.1	39.3	16.5

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP05/SB6	07TP05/SB7	07TP06/SB1	07TP06/SB1D	07TP06/SB2	07TP06/SB3	07TP06/SB4
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		5	6	0	0	1	2	3
Sample Depth To:		6	7	1	1	2	3	4
Laboratory Number:		366239	366240	366241	366242	366381	366382	366383
Sample Type:					Duplicate			
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.1 U	0.14 BJ*	10.5 J*	10.3 J*	0.09 UJ*	0.08 UJ*	0.06 UJ*
Lead, Total	mg/Kg	17.7	40.2	58	69.6	57.4 J*	26.9 J*	19.2 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP06/SB5	07TP06/SB6	07TP06/SB7	07TP07/SB1	07TP07/SB2	07TP07/SB3	07TP07/SB4
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		4	5	6	0	1	2	3
Sample Depth To:		5	6	7	1	2	3	4
Laboratory Number:		366384	366385	366386	366387	366388	366389	366390
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.76 BJ*	0.08 UJ*	2.2 J*	1.2 J*	7.6 J*	4.2 J*	70.3 J*
Lead, Total	mg/Kg	15.7 J*	11.9 J*	213 J*	344 J*	1,340 J*	130 J*	7,930 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP07/SB5	07TP07/SB6	07TP07/SB7	07TP08/SB1	07TP08/SB2	07TP08/SB3	07TP08/SB4
Date Sampled:		09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998	09/16/1998
Sample Depth From:		4	5	6	0	1	2	3
Sample Depth To:		5	6	7	1	2	3	4
Laboratory Number:		366391	366392	366393	366407	366408	366409	366410
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.56 BJ*	0.08 UJ*	0.15 BJ*	3.4 J*	3.4 J*	2.4 J*	0.09 UJ*
Lead, Total	mg/Kg	117 J*	14.9 J*	161 J*	455 J*	344 J*	165 J*	11.1 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP08/SB5	07TP08/SB6	07TP08/SB7	07TP09/SB1	07TP09/SB2	07TP09/SB2D	07TP09/SB3
Date Sampled:		09/16/1998	09/16/1998	09/17/1998	09/17/1998	09/16/1998	09/17/1998	09/17/1998
Sample Depth From:		4	5	6	0	1	1	2
Sample Depth To:		5	6	7	1	2	2	3
Laboratory Number:		366411	366412	366421	366422	366413	366428	366423
Sample Type:							Duplicate	
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.22 BJ*	2.1 BJ*	0.1 UJ*	4.5 J*	1.8 J*	3.7 J*	6.9 J*
Lead, Total	mg/Kg	28.3 J*	28.3 J*	11.4 J*	336 J*	211 J*	318 J*	108 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP09/SB4	07TP09/SB5	07TP09/SB6	07TP09/SB7	07TP10/SB1	07TP10/SB2	07TP10/SB3
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		3	4	5	6	0	1	2
Sample Depth To:		4	5	6	7	1	2	3
Laboratory Number:		366424	366425	366426	366427	366429	366430	366431
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	1 J*	0.19 BJ*	2.8 J*	1.7 J*	3.2 J*	0.09 UJ*	5.4 J*
Lead, Total	mg/Kg	203 J*	184 J*	379 J*	150 J*	182 J*	567 J*	21.5 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP10/SB4	07TP10/SB5	07TP10/SB6	07TP10/SB7	07TP11/SB1	07TP11/SB2	07TP11/SB3
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		3	4	5	6	0	1	2
Sample Depth To:		4	5	6	7	1	2	3
Laboratory Number:		366432	366433	366434	366435	366436	366437	366438
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	3.3 BJ*	4.7 J*	0.86 J*	10.9 J*	3.5 J*	11 J*	0.21 BJ*
Lead, Total	mg/Kg	59.4 J*	68.1 J*	182 J*	135 J*	310 J*	401 J*	183 J*

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP11/SB4	07TP11/SB5	07TP11/SB6	07TP11/SB7	07TP12/SB1	07TP12/SB2	07TP12/SB3
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		3	4	5	6	0	1	2
Sample Depth To:		4	5	6	7	1	2	3
Laboratory Number:		366439	366440	366451	366452	366453	366454	366455
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	1.2 J*	0.08 UJ*	2.6 J*	4.4 BJ*	5.8 J*	5.4 J*	41.4 J*
Lead, Total	mg/Kg	182 J*	113 J*	269	94.7	408	507	561

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP12/SB4	07TP12/SB4D	07TP12/SB5	07TP12/SB6	07TP12/SB7	07TP13/SB1	07TP13/SB2
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		3	3	4	5	6	0	1
Sample Depth To:		4	4	5	6	7	1	2
Laboratory Number:		366456	366457	366458	366459	366460	366461	366462
Sample Type:			Duplicate					
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	7 J*	2.3 J*	2.7 J*	6.4 J*	3 J*	2.3 J*	9.8 J*
Lead, Total	mg/Kg	342	181	195	81.1	364	237	956

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP13/SB3	07TP13/SB4	07TP13/SB5	07TP13/SB6	07TP13/SB7	07TP14/SB1	07TP14/SB2
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		2	3	4	5	6	0	1
Sample Depth To:		3	4	5	6	7	1	2
Laboratory Number:		366463	366464	366465	366466	366467	366468	366469
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	4.5 J*	6.8 J*	1.6 J*	9.1 J*	1.6 J*	5.8 J*	8.7 J*
Lead, Total	mg/Kg	341	537	1,220	691	532	449	997

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP14/SB3	07TP14/SB4	07TP14/SB5	07TP14/SB6	07TP14/SB7
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		2	3	4	5	6
Sample Depth To:		3	4	5	6	7
Laboratory Number:		366470	366471	366472	366473	366474
Sample Type:						
<b>Metals, Total</b>	<b>UNITS</b>					
Cadmium, Total	mg/Kg	5.2 J*	6.1 J*	3 J*	0.19 B J*	3.8 B J*
Lead, Total	mg/Kg	749	235	595	358	292

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP15/SB1	07TP15/SB2	07TP15/SB3	07TP15/SB4	07TP15/SB5	07TP15/SB5D	07TP15/SB6
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		0	1	2	3	4	4	5
Sample Depth To:		1	2	3	4	5	5	6
Laboratory Number:		366519	366520	366521	366522	366523	366524	366525
Sample Type:							Duplicate	
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.07 UJ*	3.3 BJ*	0.59 J*	0.15 BJ*	3 BJ*	4.8 BJ*	2.7 BJ*
Lead, Total	mg/Kg	93.6 J*	137 J*	227 J*	70.5 J*	96.6 J*	97.2 J*	126 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP15/SB7	07TP16/SB1	07TP16/SB2	07TP16/SB3	07TP16/SB4	07TP16/SB5	07TP16/SB6
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		6	0	1	2	3	4	5
Sample Depth To:		7	1	2	3	4	5	6
Laboratory Number:		366526	366490	366513	366514	366515	366516	366517
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	0.06 UJ*	0.95	1.1 J*	0.07 UJ*	1.4 J*	1.9 BJ*	0.07 UJ*
Lead, Total	mg/Kg	103 J*	132 J*	533 J*	114 J*	78.4 J*	44.5 J*	71 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP16/SB7	07TP17/SB1	07TP17/SB2	07TP17/SB3	07TP17/SB4	07TP17/SB5	07TP17/SB6
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		6	0	1	2	3	4	5
Sample Depth To:		7	1	2	3	4	5	6
Laboratory Number:		366518	366483	366484	366485	366486	366487	366488
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	2.3 BJ*	148	210	77	55	170	221
Lead, Total	mg/Kg	94.8 J*	4,500 J*	6,990 J*	3,790 J*	1,930 J*	4,790 J*	7,980 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP17/SB7	07TP18/SB1	07TP18/SB2	07TP18/SB3	07TP18/SB4	07TP18/SB5	07TP18/SB6
Date Sampled:		09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998	09/17/1998
Sample Depth From:		6	0	1	2	3	4	5
Sample Depth To:		7	1	2	3	4	5	6
Laboratory Number:		366489	366475	366476	366477	366478	366479	366480
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	83.3	0.88	5	3.5 B	5.1 B	5.7	3.8 B
Lead, Total	mg/Kg	2,530 J*	126 J*	105 J*	48.3 J*	103 J*	137 J*	49.8 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-4**  
**SWMU 7 Phase 2 Test Pit Soil Results**  
**Armco Kansas City Facility**

Sample Point:		07TP18/SB6D		07TP18/SB7	
Date Sampled:		09/17/1998		09/17/1998	
Sample Depth From:		5		6	
Sample Depth To:		6		7	
Laboratory Number:		366481		366482	
Sample Type:		Duplicate			
<b>Metals, Total</b>		<b>UNITS</b>			
Cadmium, Total		mg/Kg	2.8	B	0.08
Lead, Total		mg/Kg	34	J*	172
					U
					J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 10-5**  
**SWMU 7 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Cadmium, Total	8	07G02 / SR1	0 - 0.5	11.9 J*
		07G02 / SR2	0.5 - 1	24.4 J*
		07G03 / SR1	0 - 0.5	37 J*
		07G03 / SR2	0.5 - 1	56 J*
		07B01 / DP1	1 - 2	22.7 J*
		07B04 / DP1	1.5 - 2.5	19.1 J*
		07B07 / DP1	0 - 1	9.77 J*
		07B12 / DP3	2 - 3	11.2 D
		07B15 / DP1	0 - 1	40 D
		07B15 / DP2	1 - 2	27.3 D
		07B17 / DP1	0 - 1	21.6 D
		07B17 / DP2	1 - 2	13.7 D
		07B17 / DP2D	1 - 2	11.7 D
		07B18 / DP1	0 - 1	29.5 D
		07B19 / DP1	0 - 1	8.43
		07B19 / DP2	1 - 2	29 D
		07B27 / DP1	0 - 1	17 D
		07B31 / DP2	1 - 2	18.5 DJ*
		07B32 / DP1	0 - 1	27 DJ*
		07B32 / DP2	1 - 2	121 DJ*
		07B32 / DP3	2 - 3	281 DJ*
		07B32A / DP4	3 - 4	41.6 J*
		07B32A / DP5	4 - 5	15.7 DJ*
		07B33 / DP1	0 - 1	9.05 DJ*
		07B37 / DP1	0 - 1	8.6
		07B37 / DP3	2 - 3	125
		07TP05 / SB1	0 - 1	19.2 J*
		07TP06 / SB1	0 - 1	10.5 J*
		07TP06 / SB1D	0 - 1	10.3 J*
		07TP07 / SB4	3 - 4	70.3 J*
		07TP10 / SB7	6 - 7	10.9 J*
		07TP11 / SB2	1 - 2	11 J*
		07TP12 / SB3	2 - 3	41.4 J*
		07TP13 / SB2	1 - 2	9.8 J*
		07TP13 / SB6	5 - 6	9.1 J*
		07TP14 / SB2	1 - 2	8.7 J*
		07TP17 / SB1	0 - 1	148
		07TP17 / SB2	1 - 2	210
		07TP17 / SB3	2 - 3	77
		07TP17 / SB4	3 - 4	55
		07TP17 / SB5	4 - 5	170
		07TP17 / SB6	5 - 6	221
		07TP17 / SB7	6 - 7	83.3

**Table 10-5**  
**SWMU 7 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Lead, Total	400	07G02 / SR1	0 - 0.5	491
		07G02 / SR2	0.5 - 1	1,030
		07G03 / SR1	0 - 0.5	1,400
		07G03 / SR2	0.5 - 1	2,010
		07B01 / DP1	1 - 2	1,000 J*
		07B04 / DP1	1.5 - 2.5	782 J*
		07B06 / DP1	0.5 - 1	1,450 J*
		07B07 / DP1	0 - 1	407 J*
		07B12 / DP3	2 - 3	1,440 D
		07B15 / DP1	0 - 1	2,220 D
		07B15 / DP2	1 - 2	1,540 D
		07B17 / DP1	0 - 1	957 D
		07B17 / DP2	1 - 2	2,540 D
		07B17 / DP2D	1 - 2	625 D
		07B18 / DP1	0 - 1	1,140 D
		07B27 / DP1	0 - 1	952 D
		07B31 / DP2	1 - 2	895 DJ*
		07B32 / DP1	0 - 1	2,570 DJ*
		07B32 / DP2	1 - 2	2620 DJ*
		07B32 / DP3	2 - 3	8530 DJ*
		07B32A / DP4	3 - 4	1400 J*
		07B32A / DP5	4 - 5	1720 DJ*
		07B32A / DP6	5 - 6	451 DJ*
		07B33 / DP1	0 - 1	480 DJ*
		07B37 / DP1	0 - 1	459 J*
		07B37 / DP3	2 - 3	14300 J*
		07TP05 / SB1	0 - 1	518
		07TP07 / SB2	1 - 2	1340 J*
		07TP07 / SB4	3 - 4	7930 J*
		07TP08 / SB1	0 - 1	455 J*
		07TP10 / SB2	1 - 2	567 J*
		07TP11 / SB2	1 - 2	401 J*
		07TP12 / SB1	0 - 1	408
		07TP12 / SB2	1 - 2	507
		07TP12 / SB3	2 - 3	561
		07TP13 / SB2	1 - 2	956
		07TP13 / SB4	3 - 4	537
		07TP13 / SB5	4 - 5	1220
		07TP13 / SB6	5 - 6	691
		07TP13 / SB7	6 - 7	532
		07TP14 / SB1	0 - 1	449
		07TP14 / SB2	1 - 2	997
		07TP14 / SB3	2 - 3	749
		07TP14 / SB5	4 - 5	595 J*
		07TP16 / SB2	1 - 2	533 J*

**Table 10-5**  
**SWMU 7 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Lead, Total (continued)	400	07TP17 / SB1	0 - 1	4500 J*
		07TP17 / SB2	1 - 2	6990 J*
		07TP17 / SB3	2 - 3	3790 J*
		07TP17 / SB4	3 - 4	1930 J*
		07TP17 / SB5	4 - 5	4790 J*
		07TP17 / SB6	5 - 6	7980 J*
		07TP17 / SB7	6 - 7	2530 J*

Notes:

D = Sample was diluted prior to analysis.

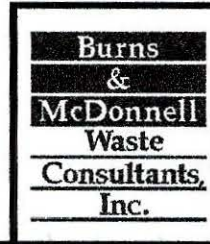
DAF = Dilution Attenuation Factor

ft = feet

J\* = Qualified as estimated by BMWCI during the QC evaluation.

SSL = Soil Screening Level





**Figure 10-1**  
**SWMU 7 SOIL**  
**SAMPLING LOCATIONS**  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



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METALS SOIL DETECTIONS ABOVE SSLs					
CADMIUM (SSL=8 mg/Kg)			LEAD (SSL=400 mg/Kg)		
SAMPLE	DEPTH (ft bgs)	RESULT (mg/Kg)	SAMPLE	DEPTH (ft bgs)	RESULT (mg/Kg)
07B01/DP1	1-2	22.7	07B01/DP1	1-2	1000
07B04/DP1	1.5-2.5	19.1	07B04/DP1	1.5-2.5	782
07B07/DP1	0-1	9.77	07B06/DP1	0.5-1	1450
07B12/DP3	2-3	11.2	07B07/DP1	0-1	407
07B15/DP1	0-1	40	07B12/DP3	2-3	1440
07B15/DP2	1-2	27.3	07B15/DP1	0-1	2220
07B17/DP1	0-1	21.6	07B15/DP2	1-2	1540
07B17/DP2	1-2	13.7	07B17/DP1	0-1	957
07B17/DP2D	1-2	11.7	07B17/DP2	1-2	2540
07B18/DP1	0-1	29.5	07B17/DP2D	1-2	625
07B19/DP1	0-1	8.43	07B18/DP1	0-1	1140
07B19/DP2	1-2	29	07B27/DP1	0-1	952
07B27/DP1	0-1	17	07B31/DP2	1-2	895
07B31/DP1	1-2	18.5	07B32/DP1	0-1	2570
07B32/DP1	0-1	27	07B32/DP2	1-2	2820
07B32/DP2	1-2	121	07B32/DP3	2-3	8530
07B32/DP3	2-3	281	07B32A/DP4	3-4	1400
07B32A/DP4	3-4	41.6	07B32A/DP5	4-5	1720
07B32A/DP5	4-5	15.7	07B32A/DP6	5-6	451
07B33/DP1	0-1	9.05	07B33/DP1	0-1	480
07B37/DP1	0-1	8.6	07B37/DP1	0-1	459
07B37/DP3	2-3	125	07B37/DP3	2-3	14300
07G02/SR1	0-0.5	11.9	07G02/SR1	0-0.5	491
07G02/SR2	0.5-1	24.4	07G02/SR2	0.5-1	1030
07G03/SR1	0-0.5	37	07G03/SR1	0-0.5	1400
07G03/SR2	0.5-1	56	07G03/SR2	0.5-1	2010
07TP05/SB1	0-1	19.2	07TP05/SB1	0-1	518
07TP06/SB1	0-1	10.5	07TP07/SB2	1-2	1340
07TP06/SB1D	0-1	10.3	07TP07/SB4	3-4	7930
07TP07/SB4	3-4	70.3	07TP08/SB1	0-1	455
07TP10/SB7	6-7	10.9	07TP10/SB2	1-2	567
07TP11/SB2	1-2	11	07TP11/SB2	1-2	401
07TP12/SB3	2-3	41.4	07TP12/SB1	0-1	408
07TP13/SB2	1-2	9.8	07TP12/SB2	1-2	507
07TP13/SB6	5-6	9.1	07TP12/SB3	2-3	561
07TP14/SB2	1-2	8.7	07TP13/SB2	1-2	956
07TP17/SB1	0-1	148	07TP13/SB4	3-4	537
07TP17/SB2	1-2	210	07TP13/SB5	4-5	1220
07TP17/SB3	2-3	77	07TP13/SB6	5-6	691
07TP17/SB4	3-4	55	07TP13/SB7	6-7	532
07TP17/SB5	4-5	170	07TP14/SB1	0-1	449
07TP17/SB6	5-6	221	07TP14/SB2	1-2	997
07TP17/SB7	6-7	83.3	07TP14/SB3	2-3	749
			07TP14/SB5	4-5	595
			07TP16/SB2	1-2	533
			07TP17/SB1	0-1	4500
			07TP17/SB2	1-2	6990
			07TP17/SB3	2-3	3790
			07TP17/SB4	3-4	1930
			07TP17/SB5	4-5	4790
			07TP17/SB6	5-6	7980
			07TP17/SB7	6-7	2530

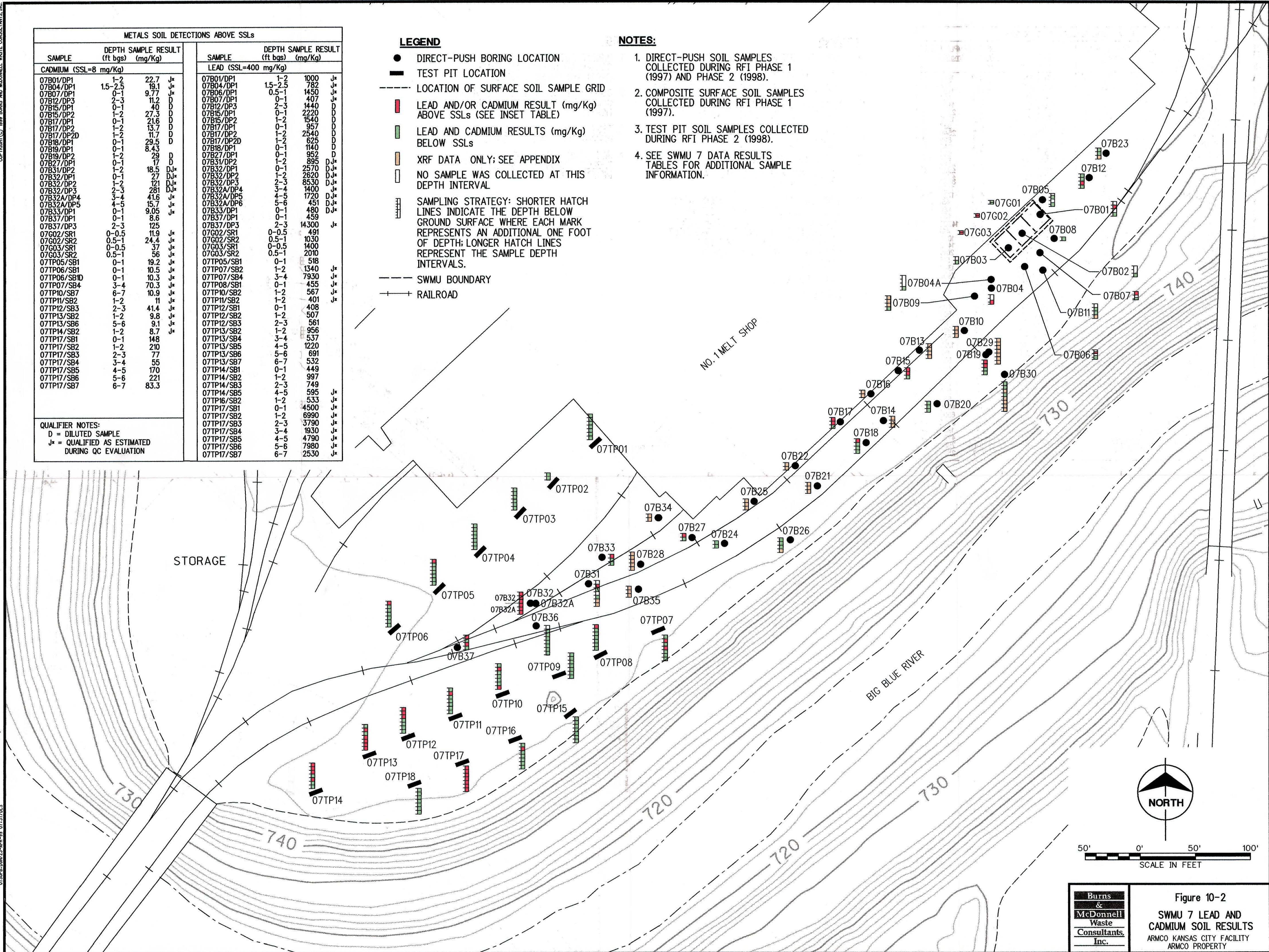
QUALIFIER NOTES:  
D = DILUTED SAMPLE  
J+ = QUALIFIED AS ESTIMATED  
DURING QC EVALUATION

#### LEGEND

- DIRECT-PUSH BORING LOCATION
- TEST PIT LOCATION
- LOCATION OF SURFACE SOIL SAMPLE GRID
- █ LEAD AND/OR CADMIUM RESULT (mg/Kg) ABOVE SSLs (SEE INSET TABLE)
- █ LEAD AND CADMIUM RESULTS (mg/Kg) BELOW SSLs
- █ XRF DATA ONLY; SEE APPENDIX
- NO SAMPLE WAS COLLECTED AT THIS DEPTH INTERVAL
- ||| SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.
- SWMU BOUNDARY
- + RAILROAD

#### NOTES:

- DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997) AND PHASE 2 (1998).
- COMPOSITE SURFACE SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
- TEST PIT SOIL SAMPLES COLLECTED DURING RFI PHASE 2 (1998).
- SEE SWMU 7 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



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**SWMUs 8 AND 11  
NO. 2 MELT SHOP BAGHOUSE DUST TANK AND  
DUST RAILCAR LOADING AREA – NO. 2 MELT SHOP  
(GST PROPERTY)**



## **11.0 SWMU 8 – NO. 2 MELT SHOP BAGHOUSE DUST TANK AND SWMU 11 – DUST RAILCAR LOADING AREA (NO. 2 MELT SHOP)**

### **11.1 SWMUS 8 AND 11 BACKGROUND**

#### **11.1.1 Description of SWMUs 8 and 11**

The No. 2 Melt Shop Baghouse Dust Tank (SWMU 8), and the Dust Railcar Loading Area No. 2 Melt Shop (SWMU 11) are located on GST property (see Figure 1-2). Currently, GST continues operations of these areas as an integral part of their manufacturing activities. Armco has not had control over the operations since the property transfer in November 1993. The defined SWMUs 8 and 11 area is approximately 80 feet by 90 feet (less than 0.2 acres) in size.

The SWMU 8 tank was constructed in 1977, and provides temporary storage for emission control dust generated in the No. 2 Melt Shop prior to transport to SWMU 11 and transfer off-site for reclamation or disposal. The emission control dust is collected in the baghouses located above the Dust Railcar Loading Area (SWMU 11). Emission control dust from each baghouse compartment (10 total) flows into a hopper directly beneath the compartment. Each of the 10 hoppers is emptied into the tank on a rotational basis with one compartment emptied approximately every 20 minutes. Transfer from the hopper to the tank is accomplished by a screw conveyor. The tank is 12 feet in diameter and approximately 18 feet high with a capacity of approximately 70 cubic yards.

From SWMU 8, the emission control dust is loaded onto railcars that move underneath the dust tank on a railroad spur located on the northwest side of the baghouses. This railcar management area (SWMU 11) was constructed in November 1988. Railcars are used to transport the emission control dust off site for recycling. At the time that SWMU 11 was installed, the SWMU 8 tank was elevated to accommodate taller railcars.

Transfer of emission control dust from the SWMU 8 tank to the railcar is achieved through a conduit that is sealed over the railcar opening. Air is evacuated from the railcar as it fills. An air

return line carries the evacuated air and any associated dust back to the storage tank. The tank is equipped with its own baghouse to allow air to escape while trapping the emission control dust.

Prior to the November 1988 construction of SWMU 11, the emission control dust was collected at the SWMU 8 tank and transferred by truck to a number of other on-site SWMUs for management. Currently, GST continues to operate SWMUs 8 and 11, and the emission control dust managed there continues to be transported off site for reclamation.

Based on the types of materials handled at SWMUs 8 and 11 prior to the property transfer to GST, the primary constituents of potential concern were lead and cadmium associated with emission control dust.

#### **11.1.2 Release Potential**

Small spills occurred during the transfer of emission control dust from the No. 2 Melt Shop Baghouse Dust Tank (SWMU 8) to railcars and trucks. On June 21, 1989, approximately 30 cubic feet of dust were spilled beneath the railcar. Approximately 10 cubic feet were spilled on September 27, 1989, due to incomplete closure of a hopper door. An unsealed hopper door resulted in a spill of approximately 36 cubic feet of dust on January 9, 1991. A spill of 15 to 20 cubic feet of dust under the loading spout was reported on May 5, 1992. In each case, the dust was reintroduced into the furnace following clean up.

The primary release potential for these SWMUs was to the surface soils. Prior to the construction of SWMU 11, the transfer of emission control dust from the tank for off-site reclamation was less controlled. In its current operational mode, a lesser potential exists for a release to the environment because the transfer paths from the hoppers to the tank and from the tank to the railcar are sealed. The majority of the area around the rail lines where loading occurs is covered with pavement.

## **11.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at these SWMUs was assessed through the collection of surface soil samples. Table 11-1 presents a summary of the investigation activities completed at SWMUs 8 and 11. Figure 11-1 depicts the sampling locations.

Because SWMU 8 is located directly above SWMU 11, the area that would have been affected by a release of emission control dust from either SWMU is the same. Therefore, these SWMUs were investigated jointly since it would be difficult to associate any contamination with one of the two SWMUs in particular. During RFI Phase 1, discrete surface soil samples (from 0 to 1 feet bgs) were collected from six locations in the area of the SWMUs and analyzed for lead and cadmium. Due to compacted fill material throughout the area, a jackhammer had to be used to collect surface soil samples.

## **11.3 NATURE AND EXTENT OF METALS CONTAMINATION IN SOIL**

Table 11-2 and Figure 11-2 present the lead and cadmium results for SWMUs 8 and 11.

Lead was detected in all of the samples taken from SWMUs 8 and 11. Lead exceeded the 20 DAF SSL of 400 mg/Kg in four of the six discrete samples (11G01, 11G02, 11G04, and 11G05). Sample 11G05 which is located inside the No. 2 Melt Shop building near the baghouse hopper doors, had the highest lead concentration at 9,090 mg/Kg. Samples 11G01, 11G02, and 11G04 which were approximately 50 feet away from 11G05 to the north, northwest, and west, respectively, all had similar lead concentrations of approximately 2,000 mg/Kg. Samples 11G03 and 11G06, which were located toward the perimeter of the SWMUs 8 and 11 area (on the west and east, respectively), contained lead concentrations below the 20 DAF SSL at 351 mg/Kg and 116 mg/Kg, respectively.

Cadmium was also detected in all six samples taken from SWMUs 8 and 11. Cadmium exceeded the 20 DAF SSL of 8 mg/Kg in five of the six samples (all except 11G06). Sample 11G05, which is located inside the No. 2 Melt Shop building near the baghouse hopper doors, had the highest cadmium concentration at 216 J\* mg/Kg. Samples 11G01, 11G02, and 11G04

all had similar cadmium concentrations of approximately 50 mg/Kg. Sample 11G03, which is the westernmost sample in the area, had a cadmium concentration slightly above the 20 DAF SSL at 8.53 J\* mg/Kg. Sample 11G06, the easternmost sample in the area, had a cadmium concentration of 2.17 J mg/Kg which is below the 20 DAF SSL.

SWMUs 8 and 11 are located within the main portion of GST's operational area. Further sampling was not implemented due to safety issues related to the nearby railyard, the large electromagnetic crane within the No. 2 Melt Shop building, and electrical utility clearance difficulties throughout this area. Therefore, the nature and extent of lead and cadmium was identified by Sample 11G06 to the east, Sample 11G03 to the west, the rail line to the north, and the No. 2 Melt Shop building operational areas to the south.

#### **11.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMUs 8 and 11, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and the air pathway (airborne dust).

The nature and extent of contamination at SWMUs 8 and 11 was assessed through the collection of surface soil samples. Lead and cadmium concentrations in the surface soil (0 to 1 foot bgs) exceeded 20 DAF SSLs (based on soil migration to groundwater), thus indicating that soil transfer to groundwater could occur. The tendency for metals to strongly adsorb to soil and the typical slightly basic to basic pH soil conditions at the Facility should limit the potential for metals to migrate vertically in soil. Areas with asphalt surface cover will also limit the potential vertical migration by limiting infiltration through the subsurface. Groundwater was not encountered or sampled during investigation activities at SWMUs 8 and 11. However, the groundwater transport pathway is not expected to be significant for SWMUs 8 and 11.

Surface cover material at SWMUs 8 and 11 is slag fill and asphalt. Storm water runs toward storm drains west of the SWMU area, and storm sewers in the area discharge to the Blue River.

Thus, storm water runoff, storm sewer transport, and surface water transport could occur. In areas that do not contain asphalt surface cover, surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. The presence of the No. 2 Melt Shop on the south side of SWMUs 8 and 11 is expected to minimize constituent migration via airborne dust transport; therefore, this is not expected to be a significant pathway.

## **11.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMUs 8 and 11.

### **11.5.1 Human Health Evaluation**

Cadmium and lead were identified as COPCs in surface soil. A HHRA and lead modeling were conducted for SWMUs 8 and 11 to evaluate potential health risks to existing or possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in surface soil at SWMUs 8 and 11. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.

### **11.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMUs 8 and 11. Therefore, an ecological risk evaluation was not conducted for SWMUs 8 and 11.

## 11.6 SUMMARY

SWMUs 8 and 11 are located in the western portion of the Facility on property owned and operated by GST, and these areas are an integral part of GST's operations. SWMU 8 provides temporary storage for emission control dust, which is then transferred to railcars (SWMU 11). The defined SWMUs 8 and 11 area is approximately 80 feet by 90 feet (less than 0.2 acres) in size. Surface soil samples were collected at SWMUs 8 and 11.

Six surface soil samples were collected for cadmium and lead analyses. As shown in Figure 11-2, cadmium and lead were detected in all six samples at concentrations ranging up to 216 J\* and 9,090 mg/Kg, respectively. Lead and/or cadmium concentrations exceeded the 20 DAF SSLs in the center of the SWMUs 8 and 11 area. However, concentrations decreased towards the western and eastern perimeters of the area to below or just slightly above 20 DAF SSLs. Because these SWMUs are located within GST's main operational area, further sampling was not implemented due to safety issues related to the nearby railyard, the large electromagnetic crane within the No. 2 Melt Shop building, and electrical utility clearance difficulties throughout this area.

Potential migration pathways at SWMUs 8 and 11 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, and airborne dust migration. Surface soil detections of cadmium and lead exceeded 20 DAF SSLs (based on soil migration to groundwater), thus indicating soil transfer to groundwater could occur. Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Based on the tendencies of metals to strongly adsorb to soil rather than migrate vertically or with groundwater movement and the slightly basic to basic soil pH conditions at the Facility, soil transfer to groundwater and groundwater transport are not expected to be significant for SWMUs 8 and 11.

Storm water runs toward storm drains west of the SWMU area, and storm sewers in the area discharge to the Blue River. Therefore, contaminant migration via storm water runoff, storm sewer transport, and surface water transport could occur. In areas that do not contain asphalt surface cover, surface soil particulate (dust) could become airborne. The prevailing wind

direction at the Facility is from the south-southwest to the north-northeast. The presence of the No. 2 Melt Shop on the south side of SWMUs 8 and 11 is expected to minimize contaminant migration via airborne dust; therefore, this is not expected to be a significant pathway.

A risk evaluation was conducted for SWMUs 8 and 11. For the human health evaluation, cadmium and lead were identified as COPCs in surface soil. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to existing and possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil at SWMUs 8 and 11 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMUs 8 and 11.

\* \* \* \* \*

**Table 11-1**  
**SWMUs 8 and 11 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis		Comments	Lab ID Number
Point	Designator				Total			
					Lead	Cadmium		
DISCRETE SURFACE SOIL SAMPLES								
11G01	SR1	0.0 - 1.0	03/31/1997	1	X	X		D97-3885-1
11G02	SR1	0.0 - 1.0	03/31/1997	1	X	X		D97-3885-2
	SR1R		03/31/1997	1	X	X	Rinsate	D97-3885-3
11G03	SR1	0.0 - 1.0	03/31/1997	1	X	X		D97-3885-4
	SR1D	0.0 - 1.0	03/31/1997	1	X	X	Field Duplicate	D97-3885-5
11G04	SR1	0.0 - 1.0	03/31/1997	1	X	X		D97-3885-6
11G05	SR1	0.0 - 1.0	03/31/1997	1	X	X		D97-3885-7
	SR1MS	0.0 - 1.0	03/31/1997	1	X	X	Matrix Spike	D97-3885-8
	SR1MSD	0.0 - 1.0	03/31/1997	1	X	X	Matrix Spike Duplicate	D97-3885-9
11G06	SR1	0.0 - 1.0	04/25/1997	1	X	X		D97-5144-20

Notes:

ft = feet



**Table 11-2**  
**SWMUs 8 and 11 Discrete Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point:		11G01/SR1	11G02/SR1	11G03/SR1	11G03/SR1D	11G04/SR1	11G05/SR1	11G06/SR1
Date Sampled:		03/31/1997	03/31/1997	03/31/1997	03/31/1997	03/31/1997	03/31/1997	04/25/1997
Sample Depth From:		0	0	0	0	0	0	0
Sample Depth To:		1	1	1	1	1	1	1
Laboratory Number:		D97-3885-1	D97-3885-2	D97-3885-4	D97-3885-5	D97-3885-6	D97-3885-7	D97-5144-20
Sample Type:					Duplicate			
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	48.8 J*	49.9 J*	8.13 J*	8.53 J*	52.3 J*	216 J*	2.17 J
Lead, Total	mg/Kg	1,930	2,000	328	351	2,020	9,090 D	116

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 11-3**  
**SWMUs 8 and 11 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Cadmium, Total	8	11G01 / SR1	0 - 1	48.8 J*
		11G02 / SR1	0 - 1	49.9 J*
		11G03 / SR1	0 - 1	8.13 J*
		11G03 / SR1D	0 - 1	8.53 J*
		11G04 / SR1	0 - 1	52.3 J*
		11G05 / SR1	0 - 1	216 J*
Lead, Total	400	11G01 / SR1	0 - 1	1,930
		11G02 / SR1	0 - 1	2,000
		11G04 / SR1	0 - 1	2,020
		11G05 / SR1	0 - 1	9,090

**Notes:**

DAF = Dilution Attenuation Factor

ft = feet

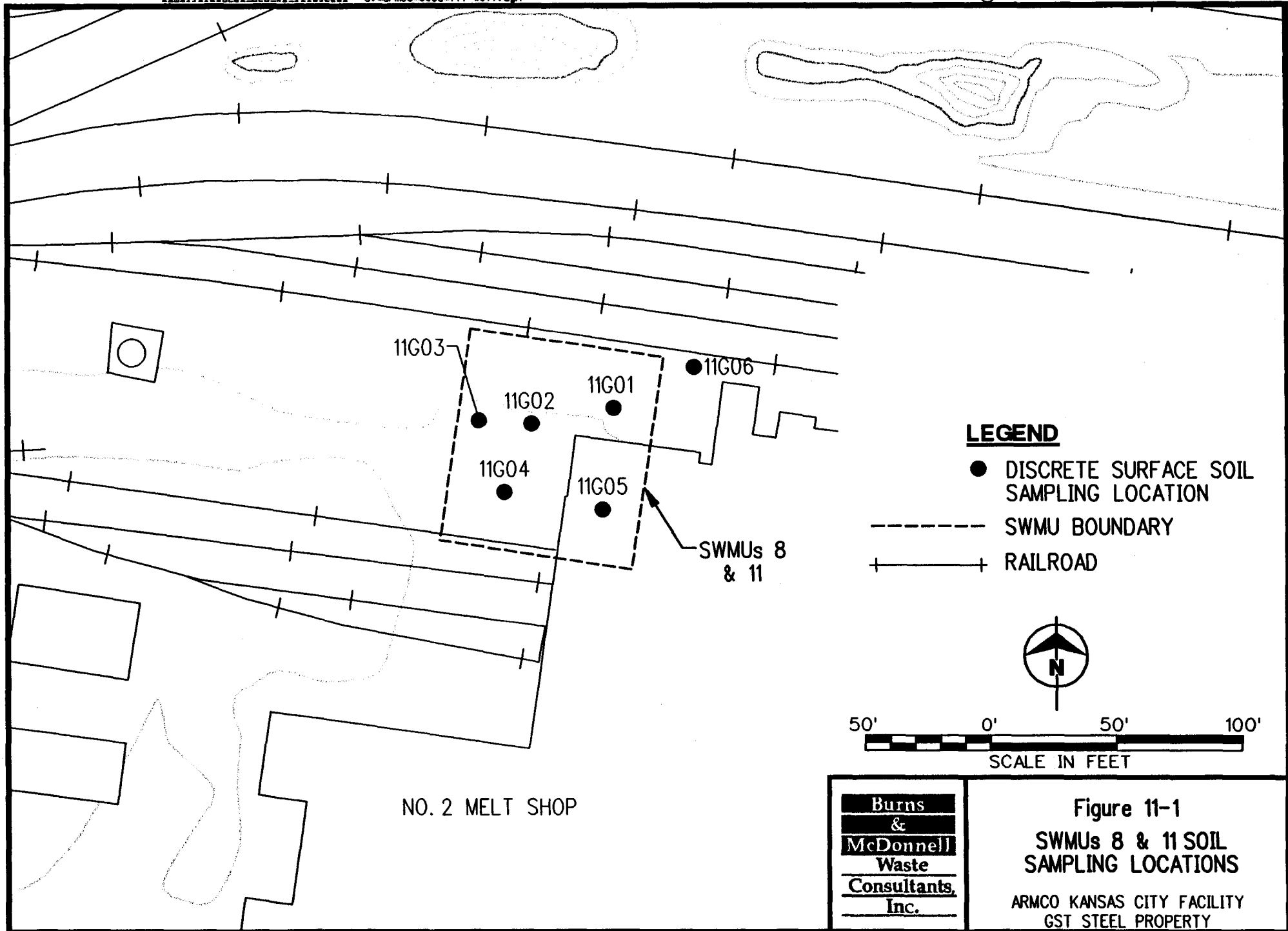
J\* = Qualified as estimated by BMWCI during the QC evaluation.

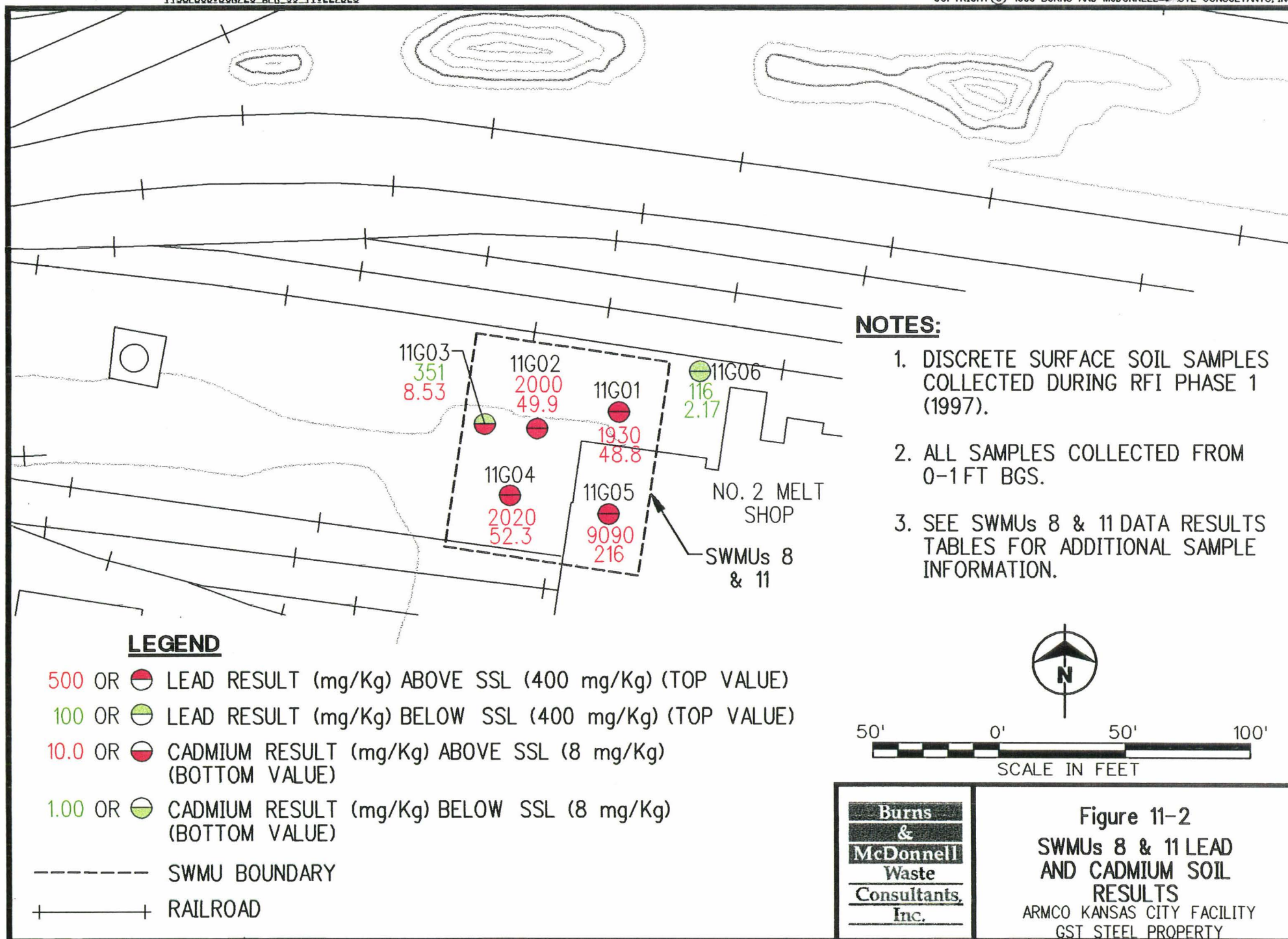
SSL = Soil Screening Level

k:\armcor\fi\ustn.sup\armconb.dgn  
k:\armcor\fi\ustn.sup\elfe.dgn  
k:\es\global\std\dr\ustn\civil\2d\wclbdr04  
k:\armcor\fi\ustn.sup\3dswmu.dgn  
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u:\armco\seed\fi11-well.dgn

SWMU118.DGN/20-APR-99\_17:24/DLS

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**SWMU 9**  
**NO. 1 MELT SHOP CANOPY BAGHOUSE DUST CONVEYOR**

## **12.0 SWMU 9 – NO. 1 MELT SHOP CANOPY BAGHOUSE DUST CONVEYOR**

### **12.1 SWMU BACKGROUND**

#### **12.1.1 Description of SWMU**

The No. 1 Melt Shop Canopy Baghouse Dust Conveyor (SWMU 9), located on Armco property (see Figure 1-2), operated between 1977 and 1988 as a part of the Secondary Emissions Control System for the No. 1 Melt Shop. The purpose of this system was to help manage emission control dust generated by the electric arc furnaces installed at the No. 1 Melt Shop. The conveyor consisted of a steel screw approximately 12 inches in diameter and 65 feet long. The conveyor was used to transfer emission control dust from the adjacent baghouse to a transfer truck for transport to and management at other on-site locations. The conveyor was removed in November 1993. The equipment was cleaned and was observed to be free of emission control dust prior to removal. No evidence of SWMU 9 remains. The defined SWMU area is approximately less than 0.1 acres in size.

Based on the types of material handled at SWMU 9 and previous sampling and analysis activities (Remcor, 1989), the primary constituents of potential concern are lead and cadmium which are associated with emission control dust.

#### **12.1.2 Release Potential**

The primary release potential for SWMU 9 was to surrounding surface soils. The potential for release was minimized since transfer activities were controlled and supervised. It is possible that some releases may have occurred during truck loading activities.

An investigation of the No. 1 Melt Shop area was performed by Remcor in 1989. From this investigation, it was noted that dust had accumulated around the Secondary Emissions Control System Baghouse, including the SWMU 9 area. Twenty-seven soil samples were collected from surface soil, shallow borings, and test pits. These samples were analyzed for total cadmium,

lead, and zinc. Based on this investigation, the volume of emission control dust which had accumulated on the ground surface was estimated as 120 cubic yards (Remcor, 1989). The emission control dust identified during this investigation was removed from the area as part of the decontamination activities at the No. 1 Melt Shop. The soil surrounding the baghouse was observed by Armco and Remcor personnel to be free of emission control dust after these decontamination activities had been performed.

## **12.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at SWMU 9 was evaluated through the collection of surface soil samples. Table 12-1 presents a summary of the investigation activities for SWMU 9.

Figure 12-1 depicts the sampling locations. Composite surface soil samples were collected from three grids (Grids 09G01 through 09G03) adjacent to the foundation for the Secondary Emission Control System for the No. 1 Melt Shop. Surface soil samples were composites of two to four aliquot locations within each grid. Samples were collected from two depth intervals (0 to 0.5 feet and 0.5 to 1 feet bgs). Surface soil samples were analyzed for cadmium and lead.

## **12.3 NATURE AND EXTENT OF METALS CONTAMINATION IN SOIL**

Table 12-2 presents the analytical results for SWMU 9. Cadmium was detected in the majority of the surface soil samples. The highest cadmium concentration was in the 0.5 to 1 foot interval at Grid 09G01 (6.12 J\* mg/Kg) which is north of the Secondary Baghouse foundation. Lead was detected in all of the surface soil samples. The highest lead concentration was also in the 0.5 to 1 foot interval at Grid 09G01 (208 J\* mg/Kg).

As shown on Figure 12-2, none of the cadmium and lead results exceeded their respective 20 DAF SSLs (8 mg/Kg for cadmium and 400 mg/Kg for lead). Therefore, the nature and extent of cadmium and lead in soil was adequately characterized at SWMU 9.

## **12.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 9, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and the air pathway (airborne dust).

The nature and extent of contamination at SWMU 9 was assessed through the collection of surface soil samples. Cadmium and lead were detected; however, all detections were below the 20 DAF SSLs (based on soil migration to groundwater). Based on the data, constituent migration via soil transfer to groundwater, groundwater transport, and storm sewer transport is not expected at SWMU 9.

Surface cover material at SWMU 9 is slag fill. Storm water runs toward the Blue River on the west side of the SWMU. At SWMU 9, surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. However, based on the data, constituent migration via storm water runoff, surface water migration, and dust migration via the air pathway is not expected at SWMU 9.

## **12.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 9.

### **12.5.1 Human Health Evaluation**

Since no chemicals were detected at concentrations exceeding risk screening levels, further human health risk evaluation was not conducted for SWMU 9.

### **12.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 9. Therefore, an ecological risk evaluation was not conducted for SWMU 9.



## 12.6 SUMMARY

SWMU 9, located in the western portion of the Facility, was a dust conveyor system utilized to manage emission control dust. The defined SWMU area is approximately less than 0.1 acres in size. Six surface soil samples were collected at SWMU 9. As shown on Figure 12-2, SWMU 9 was adequately characterized by the analytical data collected. Cadmium and lead were either non-detect, or detected at concentrations below the 20 DAF SSLs (8 and 400 mg/Kg, respectively).

Potential migration pathways at SWMU 9 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, and airborne dust migration. Surface soil samples showed no detections of cadmium and lead that exceeded 20 DAF SSLs (based on soil migration to groundwater). Based on the data, contaminant migration via soil transfer to groundwater, groundwater transport, and storm sewer transport is not expected for SWMU 9. In addition, contaminant migration via storm water runoff to the Blue River, surface water transport, and/or airborne dust transport are not expected at SWMU 9.

A risk evaluation was conducted for SWMU 9. For the human health evaluation, no COPCs were identified. Therefore, further human health risk evaluation was not performed. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 9.

\* \* \* \* \*

**Table 12-1**  
**SWMU 9 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis		Comments	Lab ID Number
Point	Designator				Total			
					Lead	Cadmium		
COMPOSITE SURFACE SOIL GRIDS								
09G01	SR1	0 - 0.5	03/11/1997	1	X	X	Field Duplicate	D97-2930-1
	SR2	0.5 - 1.0	03/11/1997	1	X	X		D97-2930-2
	SR2D	0.5 - 1.0	03/11/1997	1	X	X		D97-2930-3
09G02	SR1	0 - 0.5	03/11/1997	1	X	X	Matrix Spike Matrix Spike Duplicate	D97-2930-4
	SR1MS	0 - 0.5	03/11/1997	1	X	X		D97-2930-5
	SR1MSD	0 - 0.5	03/11/1997	1	X	X		D97-2930-6
	SR2	0.5 - 1.0	03/11/1997	1	X	X		D97-2930-7
09G03	SR1	0 - 0.5	03/11/1997	1	X	X	Rinsate	D97-2930-8
	SR1R		03/11/1997	1	X	X		D97-2930-9
	SR2	0.5 - 1.0	03/11/1997	1	X	X		D97-2930-10

Notes:

ft = feet

**Table 12-2**  
**SWMU 9 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point:		09G01/SR1	09G01/SR2	09G01/SR2D	09G02/SR1	09G02/SR2	09G03/SR1	09G03/SR2
Date Sampled:		03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997	03/11/1997
Sample Depth From:		0	0.5	0.5	0	0.5	0	0.5
Sample Depth To:		0.5	1	1	0.5	1	0.5	1
Laboratory Number:		D97-2930-1	D97-2930-2	D97-2930-3	D97-2930-4	D97-2930-7	D97-2930-8	D97-2930-10
Sample Type:				Duplicate				
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	4.21 J*	5.93 J*	6.12 J*	1.19 J	2.18 UJ*	1.77 J	2.16 UJ*
Lead, Total	mg/Kg	183 J*	200 J*	208 J*	55.9	33.2 J*	82.4 J*	31.5 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

HWY 24

BIG BLUE RIVER

720

730

740

09G01

SECONDARY BAGHOUSE  
FOUNDATION

09G02

09G03

750



**LEGEND**

- SWMU BOUNDARY
- - - - SURFACE SOIL SAMPLING GRID

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McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 12-1**  
**SWMU 9 SOIL**  
**SAMPLING LOCATIONS**  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY

## LEGEND

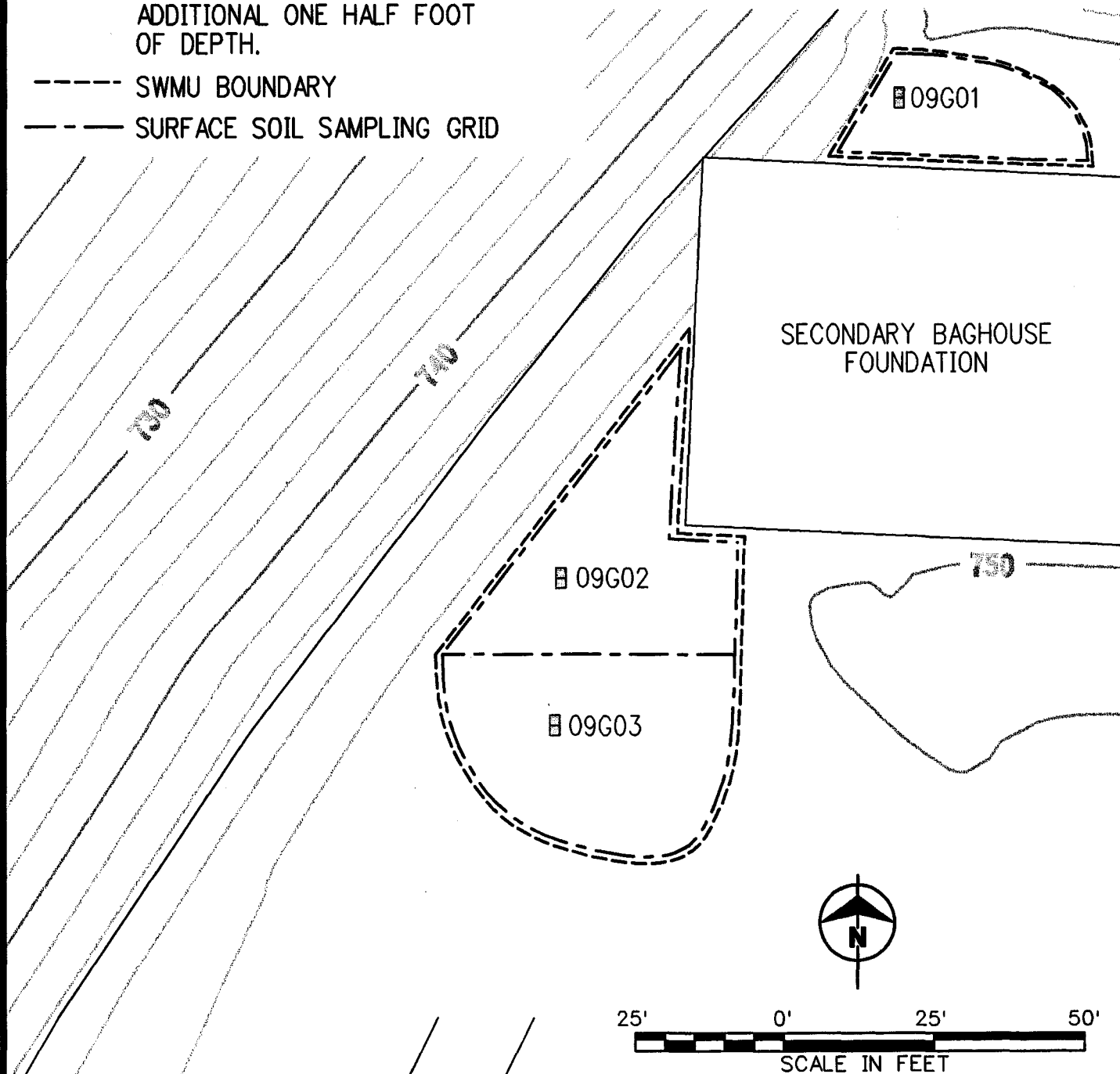
LEAD AND CADMIUM RESULTS (mg/Kg)  
BELOW SSLs

SAMPLING STRATEGY: HATCH  
LINES INDICATE THE SAMPLING  
DEPTH BELOW GROUND SURFACE  
WHERE EACH MARK REPRESENTS AN  
ADDITIONAL ONE HALF FOOT  
OF DEPTH.

----- SWMU BOUNDARY  
----- SURFACE SOIL SAMPLING GRID

## NOTES:

1. COMPOSITE SURFACE SOIL  
SAMPLES COLLECTED DURING RFI  
PHASE 1 (1997).
2. SEE SWMU 9 DATA RESULTS  
TABLES FOR ADDITIONAL SAMPLE  
INFORMATION.



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McDonnell  
Waste  
Consultants,  
Inc.

Figure 12-2  
SWMU 9 LEAD AND  
CADMIUM SOIL RESULTS  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY

**SWMU 10**  
**DUST RAILCAR LOADING AREA – BAR JOIST BUILDING**  
**(GST PROPERTY)**

## **13.0 SWMU 10 – DUST RAILCAR LOADING AREA (BAR JOIST BUILDING)**

### **13.1 SWMU BACKGROUND**

#### **13.1.1 Description of SWMU**

The Dust Railcar Loading Area (SWMU 10), located on GST property (see Figure 1-2), was a railcar loading station for emission control dust from the No. 1 and No. 2 Melt Shops. Starting in 1986, Armco began transporting emission control dust from SWMU 6 and the melt shops to SWMU 10. Emission control dust was transported to SWMU 10 by truck and loaded into railcars for off-site disposal. SWMU 10 continued to handle emission control dust until May 1991. A review of Armco records indicated that approximately 70,000 tons of emission control dust were loaded at SWMU 10 from 1986 to 1991. When emission control dust handling operations at the SWMU ceased in 1991, residual emission control dust was removed from the SWMU, and the floor and walls of the Bar Joist Building were cleaned.

The defined SWMU 10 areas are approximately less than 0.1 acres (southern portion of SWMU 10 at the Bar Joist Building) and 0.25 acres (northern portion of SWMU 10) in size.

SWMU 10 was included in the Permit as an IM SWMU. As described in the Permit, USEPA determined that IM should be undertaken to clean and assess the integrity of SWMU 10 to prevent the movement of wastes into the environment. During a visit to the SWMU by Armco and BMWCI personnel in early 1995 (in an effort to prepare the IM Plan), an area of exposed soil adjacent to the west wall of the of the Bar Joist Building was visually assessed to be slightly stained. This soil was considered the most likely area to be impacted by SWMU operations and was the focus of soil sampling activities. The area of SWMU 10 north of the Bar Joist Building is paved and no indication of dust was observed. IM activities completed are summarized in Section 13.2 of this Chapter.

Based on the types of materials handled at SWMU 10 prior to the property transfer to GST, the primary constituents of potential concern were lead and cadmium associated with emission control dust.

### **13.1.2 Release Potential**

No records of any spills or releases are associated with this SWMU. The primary release potential for this SWMU was to the surrounding surface soils. It is not anticipated that significant releases to the environment occurred since the majority of the area around the rail lines where loading occurred was covered with pavement throughout the operational life of the SWMU and the Area was cleaned on a regular basis by Armco personnel. In addition, weekly inspections performed by an Armco representative to assess the integrity of SWMU 10 did not document any releases to the environment.

## **13.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of surface and subsurface soil samples. Table 13-1 presents a summary of investigation activities for SWMU 10, and Figure 13-1 shows the sampling locations.

### **13.2.1 Interim Measures Activities**

During the 1996 IM investigation, surface soil samples were collected from six grids (Grids 10G01 through 10G06) located along the west wall of the Bar Joist Building (Figure 13-1). Composite samples were collected from two depth intervals (0 to 6 and 6 to 12 inches bgs) at each sample grid. Each sample was the composite of four aliquots collected from the sample grid. SWMU 10 surface soil samples were analyzed for cadmium and lead.

A subsurface soil investigation was conducted at SWMU 10 in September 1997 in conjunction with RFI Phase 1 investigation activities to obtain information regarding the vertical extent of cadmium and lead concentrations. Six direct-push borings (Borings 10B01 to 10B06) were advanced in the approximate center of each previously sampled surface soil grid location from



the 1996 IM investigation. Samples were collected from two to three depth intervals (0 to 2 feet, 2 to 4 feet, and 4 to 8 feet bgs) from each boring. Samples were analyzed for cadmium and lead.

### **13.2.2 Excavation and Paving Activities**

Excavation activities were performed at SWMU 10 to match the pavement to existing grade and facilitate surface drainage. Excavation activities were performed from October 21 to 24, 1997 in accordance with the *SWMU 10 Workplan* (BMWCI, 1997c). Excavation activities included the removal of soil from SWMU 10 from the area highlighted in Figure 13-1. Surface soil was excavated on both the sides of the western wall of the Bar Joist Building. The total dimensions of the excavation varied from approximately 17 feet wide on the north end to 26 feet wide on the south end by 150 feet long. Figure 13-2 indicates the depths of the excavation. In the center of the area, excavation was completed to between 2 to 4.5 feet bgs. Around this central area, excavation was completed to approximately 1 to 2 feet bgs. On the east side of the excavation area, excavation was completed to approximately 0.5 to 1 foot bgs. The approximate volume of surface soil removed was 180 cubic yards.

Confirmation soil samples were obtained to document concentrations of cadmium and lead remaining in the excavation floor prior to backfilling and paving the area. Ten confirmation soil samples (10CF01 through 10CF10) were collected, and the sampling locations are shown on Figures 13-1 and 13-2. Sample locations 10CF01 through 10CF06 correspond to direct push sample locations 10B01 through 10B06. Samples 10CF07 and 10CF09 were collected at the south end of the excavation area, and Samples 10CF08 and 10CF10 were collected at the north end of the excavation area. All soil confirmation samples were analyzed for cadmium and lead.

Following excavation activities, the excavated area was backfilled with a subbase material consisting of 1-inch minus crushed limestone gravel, to within approximately three inches of the existing grade. The area was then paved with asphalt (approximately three to four inches in thickness) to match the grade, and to allow for proper drainage. Further information regarding the excavation and paving activities is provided in *SWMU 10 Excavation and Paving Activities Report* (BMWCI, 1998).

### 13.3 NATURE AND EXTENT OF METALS CONTAMINATION IN SOIL

Due to excavation and paving activities performed at SWMU 10, soil represented by the composite surface soil samples and many of the upper depth intervals of the direct-push boring soil samples is no longer present at the SWMU. Therefore, the nature and extent discussion focuses only on those samples that represent materials remaining in place subsequent to the excavation and paving. Table 13-2 presents the direct-push soil results and Table 13-3 presents the confirmation sample soil results for these samples. Figure 13-3 presents the lead and cadmium soil results for SWMU 10. Results for the composite surface soil samples are presented in the *Interim Measures Investigation Report* (BMWCI, 1997a). Comprehensive results for the direct-push soil boring samples are presented in *SWMU 10 Excavation and Paving Activities Report* (BMWCI, 1998).

With the exception of confirmation sampling location 10CF02 (located in the deepest part of the excavation), cadmium was detected in all of the subsurface soil samples. Thirteen samples were collected from the upper soil intervals (0.5 to 2 feet bgs), and these samples contained the highest cadmium concentrations (5.16 to 35.8 mg/Kg). Results for seven of these samples exceeded the 20 DAF SSL for cadmium (8 mg/Kg). Cadmium concentrations decreased with increasing sample depth, and ranged from 1.84 J\* to 11.3 J\* mg/Kg in the 2 to 4 feet bgs depth interval. Cadmium was not detected in concentrations exceeding the 20 DAF SSL in samples collected below four feet bgs. Soil results that exceeded the 20 DAF SSL for cadmium are presented in Table 13-4.

Lead was detected in all of the subsurface soil samples. Thirteen samples were collected from the upper soil intervals (0.5 to 2 feet bgs), and these samples contained the highest lead concentrations (208 to 1,940 mg/Kg). Results for seven of these samples exceeded the 20 DAF SSL for lead (400 mg/Kg). Lead concentrations decreased with increasing sample depth, and ranged from 56.1 J\* to 698 J\* mg/Kg in the 2 to 4 feet bgs depth interval. Lead was not detected in concentrations exceeding the 20 DAF SSL in samples collected below 4 feet bgs. Soil results that exceeded the 20 DAF SSL for lead are presented in Table 13-4.

Figure 13-3 shows the lead and cadmium results for SWMU 10 and indicates the vertical and horizontal limits of the excavated soils. Exceedences of the 20 DAF SSLs were typically encountered in shallow samples (above 2.5 feet bgs) which were collected from inside the Bar Joist Building, and the horizontal extent of lead and cadmium was less clearly defined in this area. The vertical extent of lead and cadmium was generally limited to the upper 2.5 feet bgs; however, the vertical extent of lead and cadmium extended as deep as 4 feet bgs at a few locations in the central and northern portions of the excavation.

#### **13.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 10, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers). As part of IM activities, surface soil materials were excavated, and the area was backfilled with clean material and surfaced with asphalt. This asphalt prevents storm water runoff contacting subsurface material and prevents soil particulate (dust) from becoming airborne. Therefore, storm water runoff, surface water transport, and airborne dust transport are not considered pathways for constituent migration at SWMU 10.

The nature and extent of contamination at SWMU 10 was assessed through the collection of confirmation soil samples (from the bottom of the excavation area) and subsurface soil samples. Lead and cadmium concentrations in soil exceeded 20 DAF SSLs (based on soil migration to groundwater) from the bottom of the excavation area (varying depths between 1.5 to 2.5 feet bgs) to 4 feet bgs (approximate deepest elevation 747 feet above MSL). Based on the asphalt cover and the typical slightly basic to basic soil pH conditions at the Facility, soil transfer to groundwater and storm sewer transport are not expected to be significant migration pathways at SWMU 10. Groundwater was not encountered during subsurface soil sampling at SWMU 10 and groundwater samples were not collected. Based on groundwater information from AOC 1 (located just southwest of SWMU 10), the alluvial saturated zone is typically encountered at approximate elevations ranging from 737 to 738 feet above MSL. Based on the vertical definition of subsurface soil contamination at depths shallower than the alluvial saturated zone, the groundwater transport pathway is not expected to be significant for SWMU 10.

## **13.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 10.

### **13.5.1 Human Health Evaluation**

Lead was identified as a COPC in subsurface soil. Lead modeling was conducted for SWMU 10 to evaluate potential health risks to existing or possible future on-site worker populations including temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant health risks posed by lead in subsurface soil at SWMU 10. The results of the lead modeling and risk evaluation are presented in Chapter 5.0 of Appendix X.

### **13.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 10. Therefore, an ecological risk evaluation was not conducted for SWMU 10.

## **13.6 SUMMARY**

SWMU 10, located in the western portion of the Facility, was a railcar loading station for emission control dust. The defined SWMU 10 areas are approximately less than 0.1 acres (southern portion of SWMU 10 at the Bar Joist Building) and 0.25 acres (northern portion of SWMU 10) in size. Investigation activities were performed in the southern portion of SWMU 10. Surface soil and subsurface soil samples were collected for cadmium and lead analyses; and subsequently the area was excavated (to depths between 1 to 4.5 feet bgs over an approximate area of approximately 0.07 acres), backfilled with clean material, and paved during IM activities. Confirmation samples were collected from the excavation surface prior to backfilling. The *SWMU 10 Excavation and Paving Activities Report* (BMWCI, 1998) presented the results of these SWMU 10 activities. For subsurface soil, lead and cadmium results were evaluated for those samples that represent materials remaining in place subsequent to the excavation and paving.

Figures 13-2 and 13-3 show the vertical and horizontal limits of the excavation and paving activities at SWMU 10, and Figure 13-3 presents the lead and cadmium results. Twelve of the 24 subsurface soil samples contained exceedences of the 20 DAF SSLs, and these exceedences were typically encountered in shallow samples (above 2.5 feet bgs) which were collected from inside the Bar Joist Building. The vertical extent of lead and cadmium was generally limited to the upper 2.5 feet bgs; however, the vertical extent of lead and cadmium extended as deep as 4 feet bgs at a few locations in the central and northern portions of the excavation. The highest concentrations for cadmium and lead (35.8 and 1,940 J\* mg/Kg, respectively) were encountered in confirmation sample 10CF06 which was located 1.5 feet bgs in the north-central portion of the excavation inside the Bar Joist Building.

Potential migration pathways at SWMU 10 include soil transfer to groundwater, groundwater transport, and storm sewer transport. Subsurface soil detections of cadmium and lead exceeded 20 DAF SSLs (based on soil migration to groundwater); thus indicating soil transfer to groundwater could occur. Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Based on the asphalt surface cover that prevents storm water infiltration, the tendencies of metals to strongly adsorb to soil rather than to migrate vertically or with groundwater movement, and the slightly basic pH conditions of soils at the Facility, soil transfer to groundwater, storm sewer transport, and groundwater transport are not expected to be significant for SWMU 10.

A risk evaluation was conducted for SWMU 10. For the human health evaluation, lead was identified as a COPC in subsurface soil. Therefore, lead modeling was conducted to evaluate potential health risks to existing or possible future on-site worker populations including temporary excavation workers. No significant risk was posed by lead in subsurface soil at SWMU 10 for this exposure scenario. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 10.

\* \* \* \* \*

**Table 13-1**  
**SWMU 10 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis		Comments	Lab ID Number
Point	Designator				Lead	Cadmium		
COMPOSITE SURFACE SOIL GRIDS								
10G01	SR1*	0 - 0.5	10/29/96	IM	X	X	Rinsate	D96-12266-1
	SR1R		10/29/96	IM	X	X		D96-12266-2
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-3
10G02	SR1*	0 - 0.5	10/29/96	IM	X	X	Field Duplicate	D96-12266-10
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-11
	SR2D*	0.5 - 1	10/29/96	IM	X	X		D96-12266-12
10G03	SR1*	0 - 0.5	10/29/96	IM	X	X	Matrix Spike Matrix Spike Duplicate	D96-12266-13
	SR1MS	0 - 0.5	10/29/96	IM	X	X		D96-12266-14
	SR1MSD	0 - 0.5	10/29/96	IM	X	X		D96-12266-15
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-16
10G04	SR1*	0 - 0.5	10/29/96	IM	X	X		D96-12266-4
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-7
10G05	SR1*	0 - 0.5	10/29/96	IM	X	X		D96-12266-5
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-8
10G06	SR1*	0 - 0.5	10/29/96	IM	X	X		D96-12266-6
	SR2*	0.5 - 1	10/29/96	IM	X	X		D96-12266-9
DIRECT-PUSH SUBSURFACE SOIL SAMPLES								
10B01	DP1	0 - 4	9/8/97	1	X	X	Rinsate	D97-10900-9
	DP2	4 - 8	9/8/97	1	X	X		D97-10900-10
	DP2R		9/8/97	1	X	X		D97-10900-11
10B02	DP1*	0 - 2	9/8/97	1	X	X		D97-10900-6
	DP2	2 - 4	9/8/97	1	X	X		D97-10900-7
	DP3	4 - 8	9/8/97	1	X	X		D97-10900-8
10B03	DP1*	0 - 2	9/8/97	1	X	X	Matrix Spike Matrix Spike Duplicate	D97-10900-1
	DP2	2 - 4	9/8/97	1	X	X		D97-10900-2
	DP2MS	2 - 4	9/8/97	1	X	X		D97-10900-3
	DP2MSD	2 - 4	9/8/97	1	X	X		D97-10900-4
	DP3	5 - 8	9/8/97	1	X	X		D97-10900-5
10B04	DP1	0 - 2	9/8/97	1	X	X	Field Duplicate	D97-10900-12
	DP1D	0 - 2	9/8/97	1	X	X		D97-10900-13
	DP2	2 - 4	9/8/97	1	X	X		D97-10900-14
	DP3	4 - 8	9/8/97	1	X	X		D97-10900-15
10B05	DP1*	0 - 2	9/8/97	1	X	X		D97-10900-16
	DP2	2 - 4	9/8/97	1	X	X		D97-10900-17
	DP3	4 - 8	9/8/97	1	X	X		D97-10900-18
10B06	DP1	0 - 2	9/8/97	1	X	X		D97-10900-19
	DP2	2 - 4	9/8/97	1	X	X		D97-10900-20
	DP3	4 - 8	9/8/97	1	X	X		D97-10900-21
CONFIRMATION SOIL SAMPLES								
10CF01	SR1	2	10/24/97	1	X	X	Field Duplicate	D97-13024-1
	SR1D	2	10/24/97	1	X	X		D97-13024-2
10CF02	SR1	4	10/24/97	1	X	X		D97-13024-3
10CF03	SR1	2	10/24/97	1	X	X		D97-13024-4
10CF04	SR1	2	10/24/97	1	X	X		D97-13024-5
10CF05	SR1	2.5	10/24/97	1	X	X	Matrix Spike Matrix Spike Duplicate	D97-13024-6
	SR1MS	2.5	10/24/97	1	X	X		D97-13024-7
	SR1MSD	2.5	10/24/97	1	X	X		D97-13024-8

**Table 13-1**  
**SWMU 10 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis		Comments	Lab ID Number
Point	Designator				Lead	Cadmium		
10CF06	SR1	1.5	10/24/97	1	X	X		D97-13024-9
10CF07	SR1	1.5	10/24/97	1	X	X		D97-13024-10
10CF08	SR1	2	10/24/97	1	X	X		D97-13024-11
10CF09	SR1	1.5	10/24/97	1	X	X		D97-13024-12
10CF10	SR1	2.5	10/24/97	1	X	X		D97-13024-13

**Notes:**

ft = feet

IM = Interim Measures

\* = Soil sample locations removed during excavation activities in the Fall of 1997. Analytical results for these samples are presented in the *Interim Measures Investigation Report* (BMWCI, 1997a).

**Table 13-2**  
**SWMU 10 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		10B01/DP1	10B01/DP2	10B02/DP2	10B02/DP3	10B03/DP2	10B03/DP3	10B04/DP1
Date Sampled:		9/8/1997	9/8/1997	9/8/1997	9/8/1997	9/8/1997	9/8/1997	9/8/1997
Sample Depth From:		0	4	2	4	2	5	0
Sample Depth To:		4	8	4	8	4	8	2
Laboratory Number:		D97-10900-9	D97-10900-10	D97-10900-7	D97-10900-8	D97-10900-2	D97-10900-5	D97-10900-12
Sample Type:								
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	5.43 J*	0.3 J	3.84 J*	0.28 J	11.2 J*	0.46 J	6.24 J*
Lead, Total	mg/Kg	188 J*	12.6 J*	107 J*	13.7 J*	226 J*	13.6 J*	484 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 13-2**  
**SWMU 10 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		10B04/DP1D 9/8/1997 0 2 D97-10900-13 Duplicate	10B04/DP2 9/8/1997 2 4 D97-10900-14	10B04/DP3 9/8/1997 4 8 D97-10900-15	10B05/DP2 9/8/1997 2 4 D97-10900-17	10B05/DP3 9/8/1997 4 8 D97-10900-18	10B06/DP1 9/8/1997 0 2 D97-10900-19	10B06/DP2 9/8/1997 2 4 D97-10900-20
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	8.28 J*	1.84 J*	0.27 J	4.7 J*	0.61 J	22.3 J*	11.3 J*
Lead, Total	mg/Kg	1,000 J*	56.1 J*	10.8 J*	698 J*	13.1 J*	1,150 J*	265 J*

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 13-2**  
**SWMU 10 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		10B06/DP3
Date Sampled:		9/8/1997
Sample Depth From:		4
Sample Depth To:		8
Laboratory Number:		D97-10900-21
Sample Type:		
<b>Metals, Total</b>	<b>UNITS</b>	
Cadmium, Total	mg/Kg	0.63 J
Lead, Total	mg/Kg	24.8 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 13-3**  
**SWMU 10 Confirmation Sample Soil Results**  
**Armco Kansas City Facility**

Sample Point:		10CF01/SR1	10CF01/SR1D	10CF02/SR1	10CF03/SR1	10CF04/SR1	10CF05/SR1	10CF06/SR1
Date Sampled:		10/24/1997	10/24/1997	10/24/1997	10/24/1997	10/24/1997	10/24/1997	10/24/1997
Sample Depth From:		2	2	4	2	2	2.5	1.5
Sample Depth To:		2	2	4	2	2	2.5	1.5
Laboratory Number:		D97-13024-1	D97-13024-2	D97-13024-3	D97-13024-4	D97-13024-5	D97-13024-6	D97-13024-9
Sample Type:			Duplicate					
<b>Metals, Total</b>	<b>UNITS</b>							
Cadmium, Total	mg/Kg	15.7	21	0.66 U	5.16	10.5	9.82 J*	35.8
Lead, Total	mg/Kg	983	747	131	208	602	647	1,940

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 13-3**  
**SWMU 10 Confirmation Sample Soil Results**  
**Armco Kansas City Facility**

Sample Point:		10CF07/SR1	10CF08/SR1	10CF09/SR1	10CF10/SR1
Date Sampled:		10/24/1997	10/24/1997	10/24/1997	10/24/1997
Sample Depth From:		1.5	2	1.5	2.5
Sample Depth To:		1.5	2	1.5	2.5
Laboratory Number:		D97-13024-10	D97-13024-11	D97-13024-12	D97-13024-13
Sample Type:					
<b>Metals, Total</b>	<b>UNITS</b>				
Cadmium, Total	mg/Kg	6.9	19.2	9.67	10.9
Lead, Total	mg/Kg	389	1,420	515	541

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 13-4**  
**SWMU 10 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Cadmium, Total	8	10B03 / DP2	2 - 4	11.2 J*
		10B04 / DP1D	0 - 2	8.28 J*
		10B06 / DP1	0 - 2	22.3 J*
		10B06 / DP2	2 - 4	11.3 J*
		10CF01 / SR1	2	15.7
		10CF01 / SR1D	2	21
		10CF04 / SR1	2	10.5
		10CF05 / SR1	2.5	9.82 J*
		10CF06 / SR1	1.5	35.8
		10CF08 / SR1	2	19.2
		10CF09 / SR1	1.5	9.67
		10CF10 / SR1	2.5	10.9
Lead, Total	400	10B04 / DP1	0 - 2	484 J*
		10B04 / DP1D	0 - 2	1,000 J*
		10B05 / DP2	2 - 4	698 J*
		10B06 / DP1	0 - 2	1,150 J*
		10CF01 / SR1	2	983
		10CF01 / SR1D	2	747
		10CF04 / SR1	2	602
		10CF05 / SR1	2.5	647
		10CF06 / SR1	1.5	1940
		10CF08 / SR1	2	1420
		10CF09 / SR1	1.5	515
		10CF10 / SR1	2.5	541

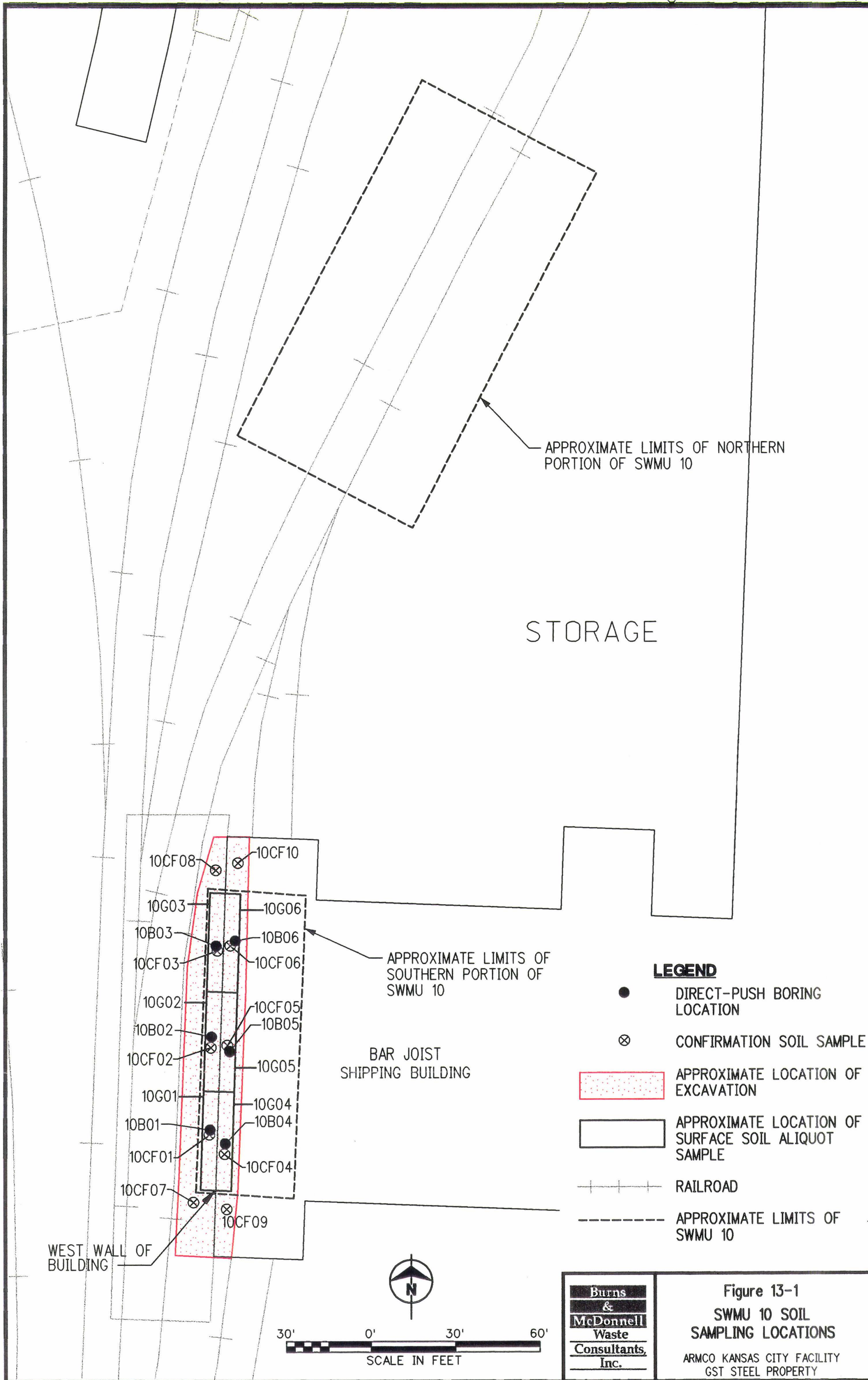
Notes:

DAF = Dilution Attenuation Factor

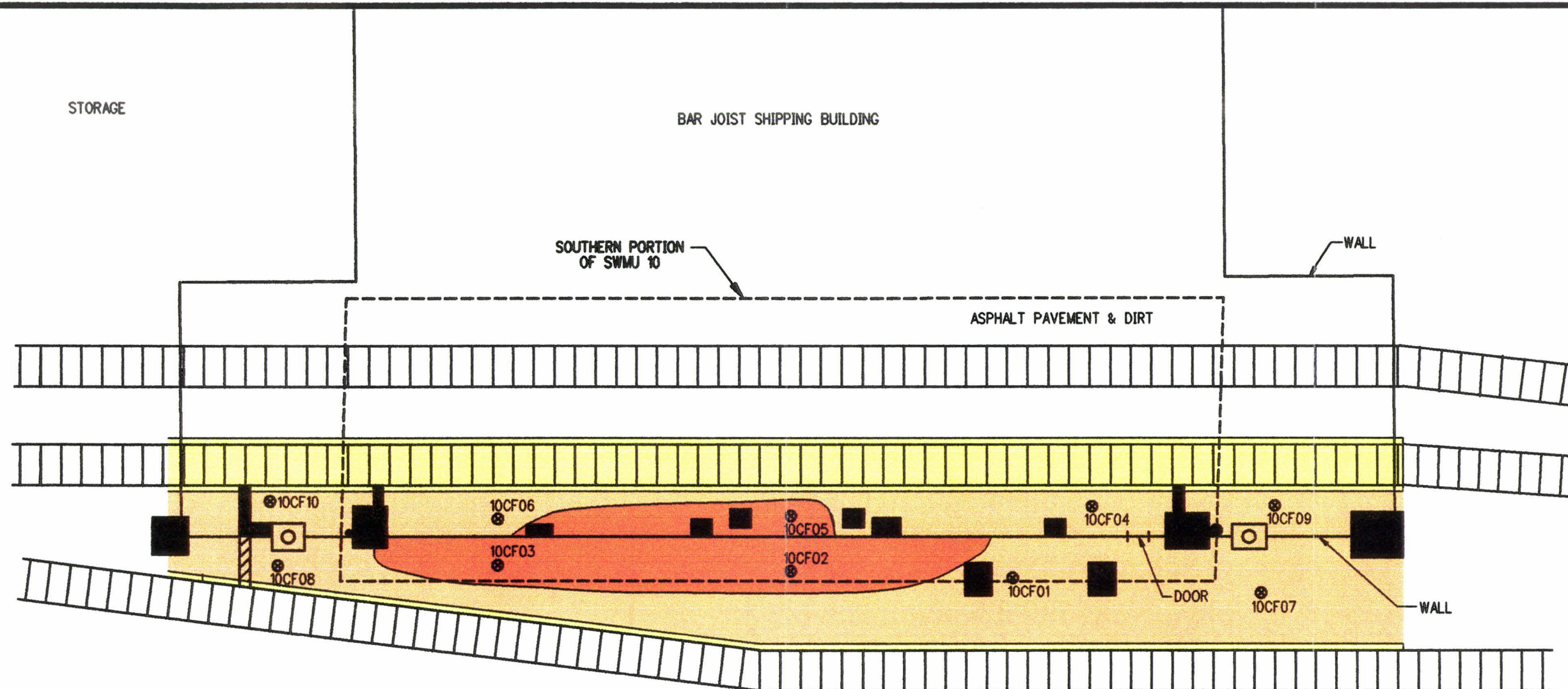
ft = feet

J\* = Qualified as estimated by BMWCI during the QC evaluation.

SSL = Soil Screening Level

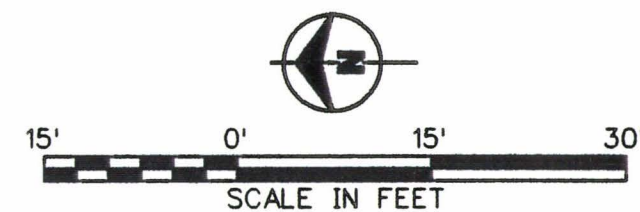






**LEGEND**

- 0.5' TO 1.0' EXCAVATION DEPTH
- 1.0' TO 2.0' EXCAVATION DEPTH
- 2.0' TO 4.5' EXCAVATION DEPTH
- CONCRETE FOOTING
- X CONFIRMATION SOIL SAMPLE
- SWMU BOUNDARY
- RAILROAD TRACK

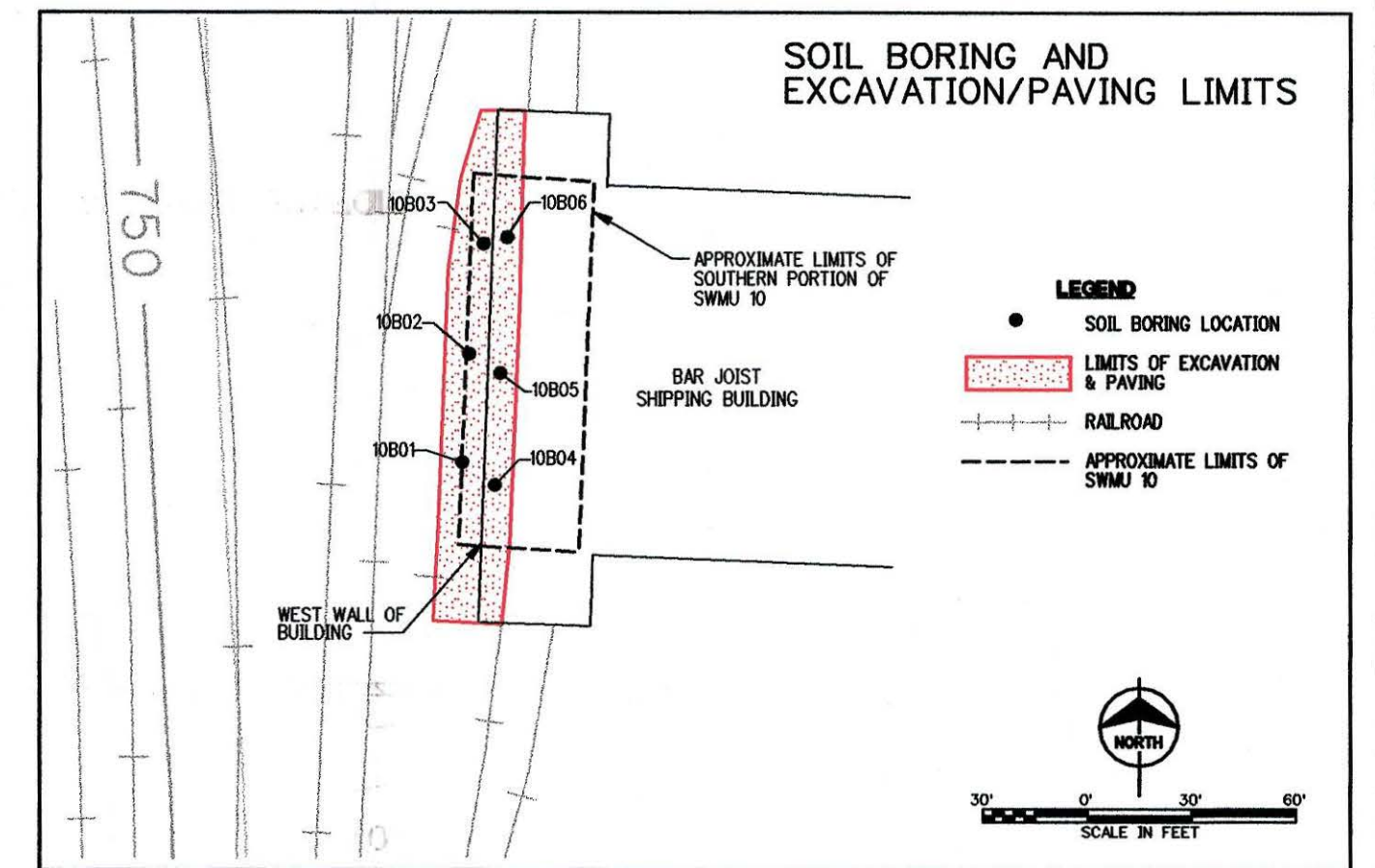
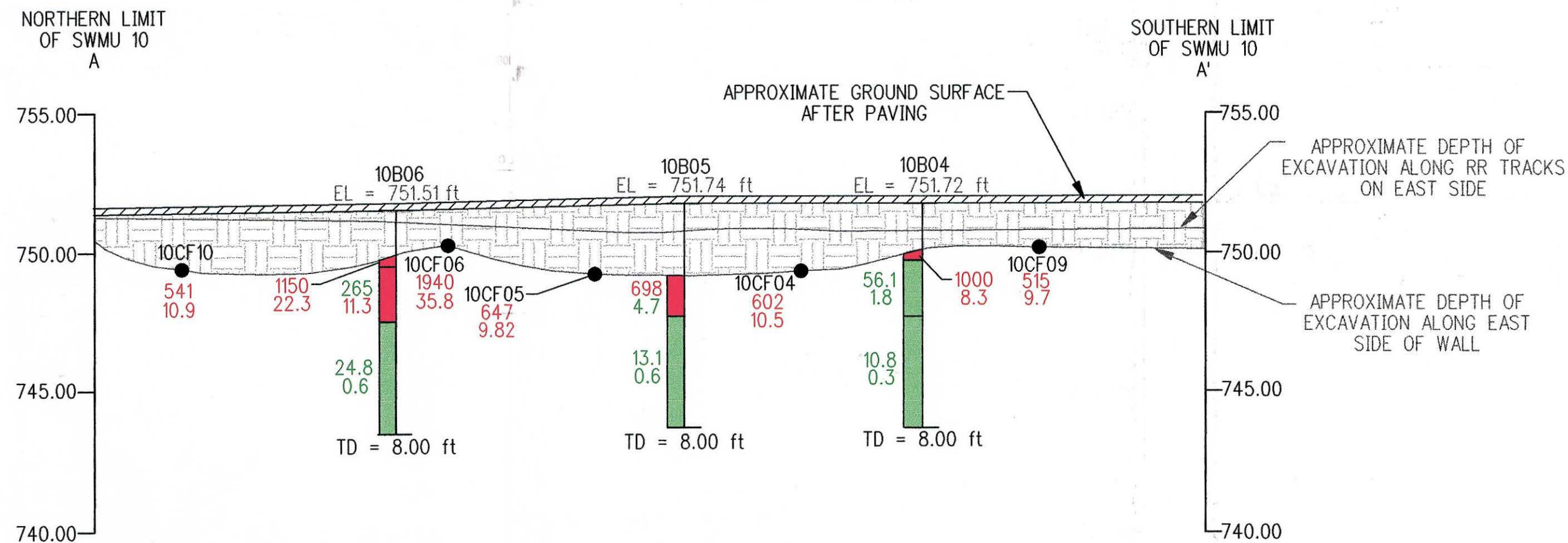


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McDonnell  
Waste  
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Inc.**

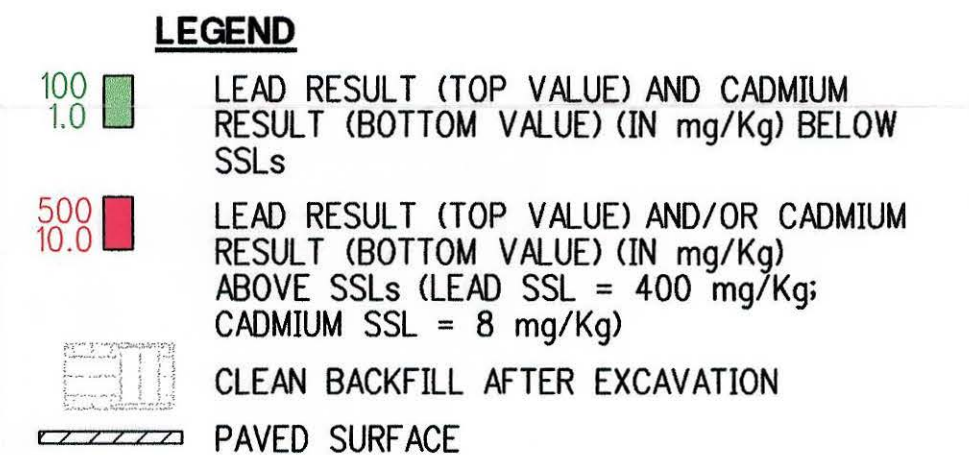
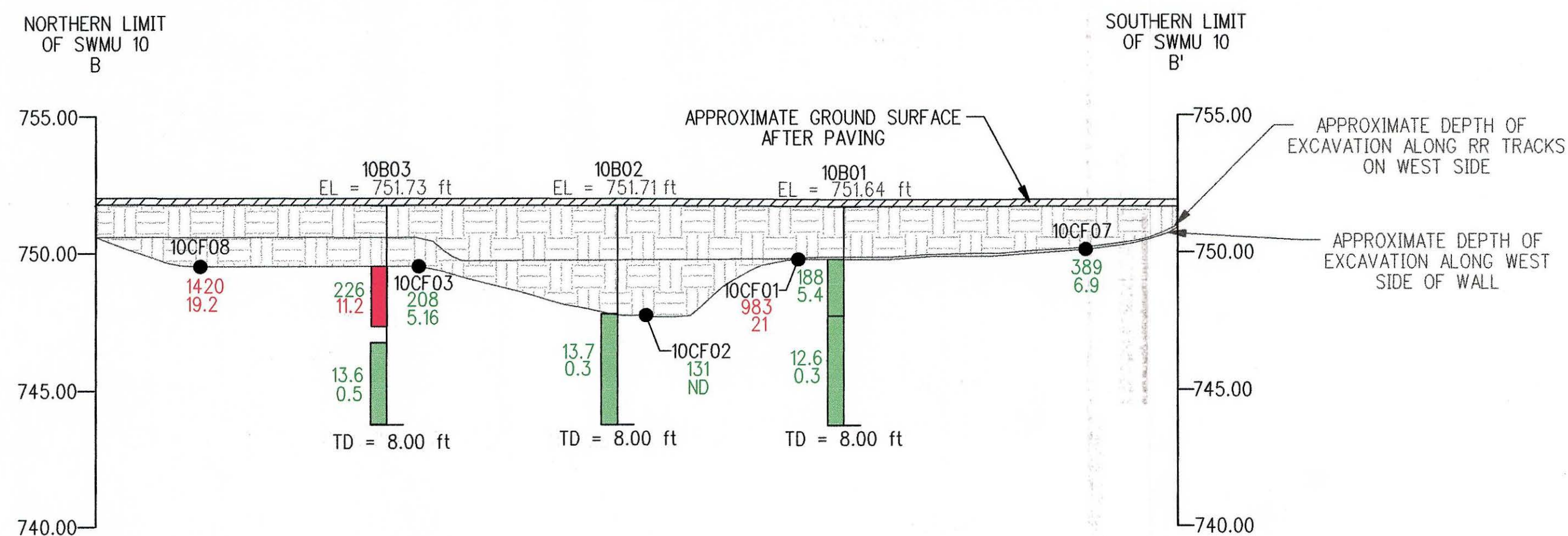
**Figure 13-2**  
**SWMU 10 EXCAVATION**  
**LIMITS AND CONFIRMATION**  
**SAMPLE LOCATION MAP**  
ARMCO KANSAS CITY FACILITY  
GST STEEL PROPERTY



# EAST SIDE OF SWMU 10 (INSIDE BUILDING)

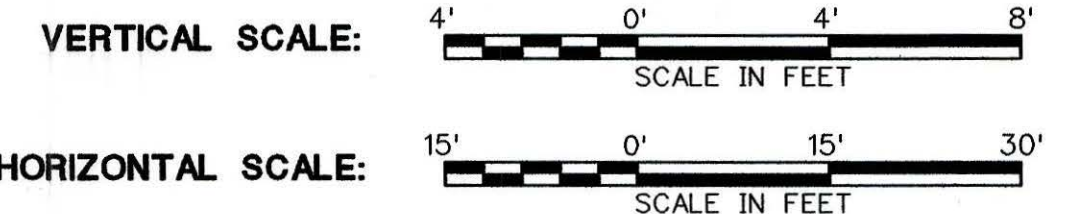


# WEST SIDE OF SWMU 10 (OUTSIDE BUILDING)



## NOTES:

- DIRECT-PUSH SOIL SAMPLES COLLECTED PRIOR TO EXCAVATION AND PAVING IN SEPTEMBER 1997.
- EXCAVATION AND BACKFILL ACTIVITIES PERFORMED IN OCTOBER 1997. CONFIRMATION SAMPLES (I.E. "10CF01") COLLECTED FOLLOWING EXCAVATION AND PRIOR TO PLACEMENT OF BACKFILL.








## VOC SOIL DETECTIONS ABOVE SSLs

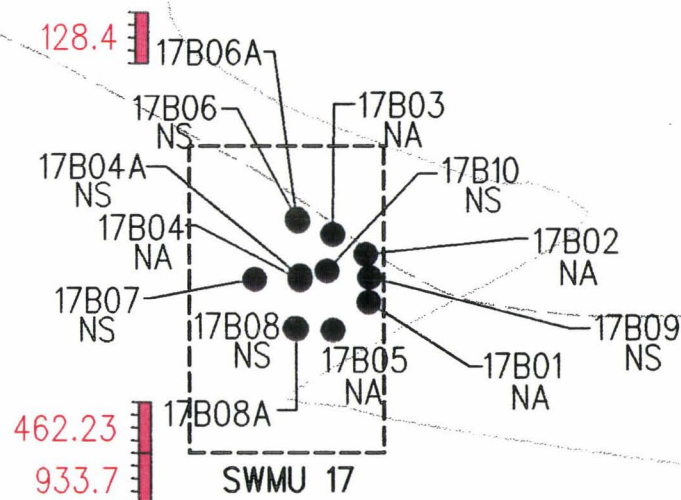
PARAMETER	SSL (ug/Kg)	SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (ug/Kg)
TRICHLOROETHENE	60	17B06A/DP1D	0-4	98.4
TRICHLOROETHENE	60	17B08A/DP1	0-4	356 D
TRICHLOROETHENE	60	17B08A/DP2	4-8	655 D

## QUALIFIER NOTES:

D - SAMPLE WAS DILUTED PRIOR TO ANALYSIS.

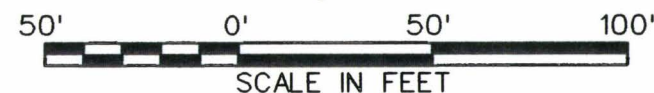
## LEGEND

- DIRECT-PUSH BORING LOCATION
- 10.0 OR  TOTAL VOC RESULTS (mg/Kg) - ALL DETECTIONS BELOW SSLs
- 10.0 OR  TOTAL VOC RESULTS (mg/Kg) - ONE OR MORE DETECTIONS ABOVE SSLs
- NA NOT ANALYZED
- ND NOT DETECTED
- NS NOT SAMPLED
-  SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.



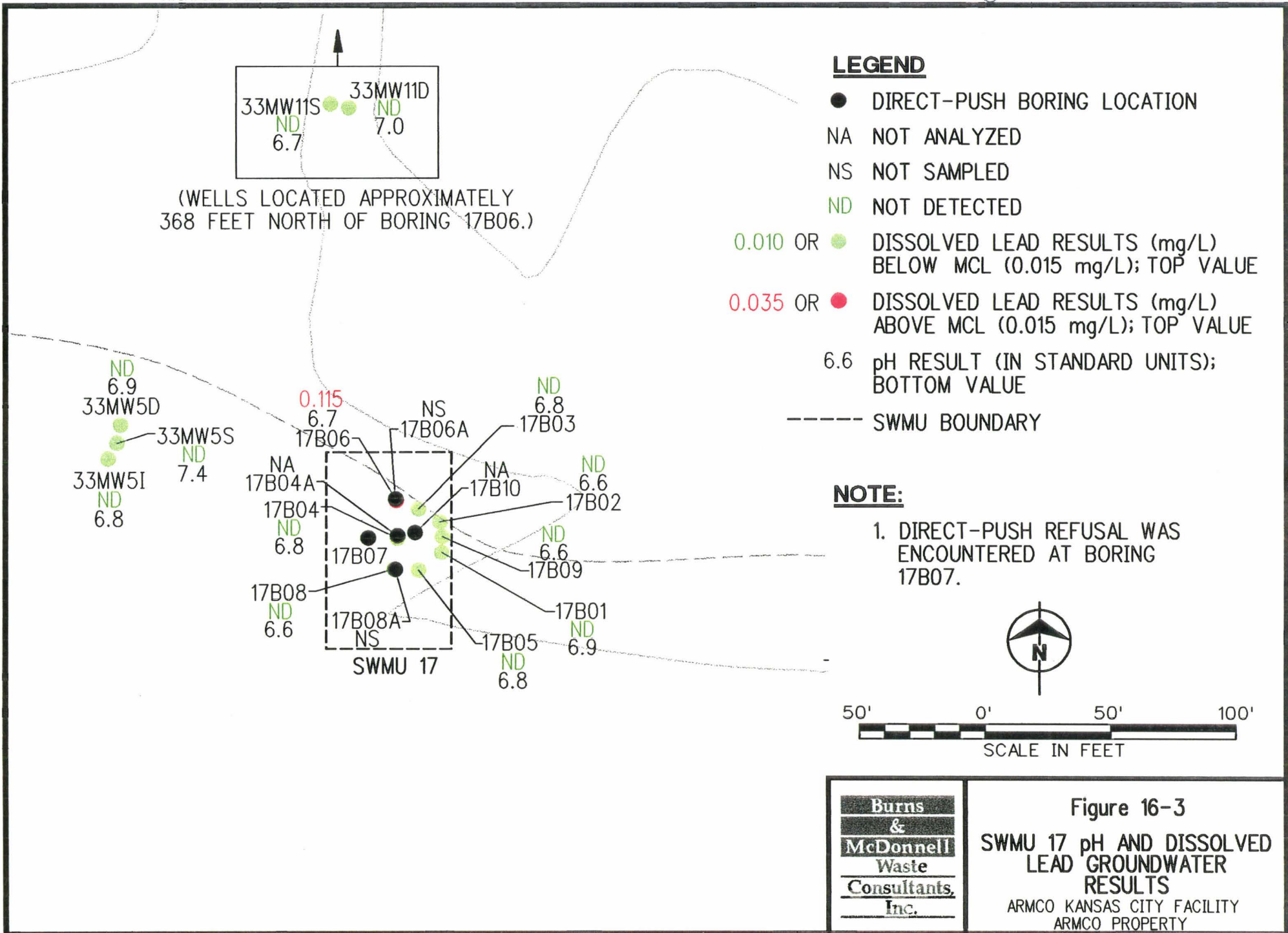
## NOTES:

- DIRECT-PUSH SAMPLES COLLECTED DURING RFI PHASE 1 (1997) AND PHASE 2 (1998).
- DIRECT-PUSH REFUSAL WAS ENCOUNTERED AT BORING 17B07.
- ONLY GROUNDWATER WAS COLLECTED FROM THE FOLLOWING LOCATIONS: 17B04A, 17B06, 17B08, 17B09, AND 17B10 (SEE SWMU 33 FOR DISCUSSION).
- SEE SWMU 17 RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



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Figure 16-2  
SWMU 17 TOTAL VOC  
SOIL RESULTS  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



**SWMU 22  
MILL PONDS  
(GST PROPERTY)**

## **17.0 SWMU 22 – MILL PONDS**

### **17.1 SWMU BACKGROUND**

#### **17.1.1 Description of SWMU**

The Mill Ponds (SWMU 22), located on GST property (see Figure 1-2), were constructed in 1976 for the cooling of mill water from various on-site locations. The two clay-lined ponds remain active. Each is in the shape of an irregular polygon and is approximately 7 feet deep and 900 feet long. The width of each pond ranges from 250 to 540 feet. The ponds are located side by side and are separated by a center berm. Each pond is equipped with an oil skimmer located near the pond outlets. Oil skimmed from the surface is transported off the Facility by Safety Kleen as part of GST's waste oil management program. In the past, skimmed oil was managed at the Waste Oil Storage Tanks (SWMU 24).

The water managed in this SWMU has come from numerous sources including the following:

1. Mill water conveyed to the ponds from the Rod Mill, 19" Rolling Mill, Continuous Casting, Ball Forging, Grinding Media, and other hot-rolling facilities which have since been demolished.
2. Groundwater from the recovery well at the abandoned fuel oil tank (AOC 1) which was managed in 1991.
3. Hydrochloric acid solution generated in the Etch Lab and spent phosphoric acid associated with the Roll Cleaning operations. Both acids were transported to the ponds from storage tanks via a tank contained on a flatbed truck. These solutions were placed in the Mill Ponds instead of purchased chemicals to control the pH of the mill water. Pickle liquor (spent sulfuric acid) was not taken to SWMU 22.

4. Precipitation falling directly on the ponds. Surface grading prevents precipitation that falls on surrounding areas from entering the ponds.

The management of mill water in these ponds allows for settlement of ferrous oxide. When the ponds were originally constructed, removal of the ferrous oxide from the ponds was anticipated to be needed on a regular basis. However, regular removal has not been necessary. In 1988, the west pond was cleaned out by dewatering the pond and removing the ferrous oxide using a dragline. The ferrous oxide removed from the pond was sold or was mixed with other ferrous oxide from the Facility and was then sold. Ferrous oxide was sold to the cement industry where it was used to increase cement iron content. The east pond had never been cleaned out prior to November 1993 when the SWMU property was transferred to GST.

Due to the property transfer from Armco to GST in 1993, a revision to the Armco NPDES Water Discharge Permit (Permit No. MO-0004952) was requested, and GST submitted an application for an NPDES permit. This request resulted in the transfer of Outfall No. 042, which is associated with the Mill Ponds, to GST. GST continues to place mill water and phosphoric acid into the Mill Ponds. The rate at which phosphoric acid is placed in the ponds is approximately 750 gallons of solution every three to four months.

During a Phase II Site Assessment conducted for the South Riverfront Expressway by Woodward-Clyde Consultants (WCC) in 1994, two borings were installed near the Mill Ponds. Boring B-3 was placed directly east of the east Mill Pond and Boring B-1 was placed near the northeast corner of the Mill Ponds. A total of five subsurface soil samples (including one field duplicate) were collected from these borings and analyzed for RCRA metals, TCLP RCRA metals, and TPH. Elevated chromium levels and TPH were detected in samples from each of the two borings. Silver was detected in samples from Boring B-1. None of the detections exceeded the TCLP limits for definition of a hazardous waste. Additional information concerning these activities was provided in Appendix A of the RFI Workplan (BMWCI, 1996a).

Analysis of the west Mill Pond sludge in 1984 indicated traces of methylene chloride, methyl ethyl ketone, carbon disulfide, BEHP, acetone, phenol, and oil and grease. Analyses of the west

Mill Pond sludge samples after cleaning in October 1988 indicated oil and grease concentrations of 4.7 and 5.8 percent. Information regarding the Mill Pond sludge analyses was provided in Appendix A of the RFI Workplan (BMWCI, 1996a).

Based on the types of materials handled at SWMU 22 prior to the property transfer to GST and previous sampling and analyses activities, the primary constituents of potential concern were VOCs, SVOCs, and metals.

#### **17.1.2 Release Potential**

There are no records of any spills or releases associated with this SWMU. The ponds are in good working order and have clay-lined bottoms. Effluent from the ponds flows into the Blue River through GSTs Outfall No. 042 which is regulated by an NPDES permit as previously discussed. The primary release potential for SWMU 22 is infiltration of the pond water to the surrounding soils and groundwater.

### **17.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of groundwater, Mill Pond water, and Mill Pond sediment samples. Table 17-1 presents a summary of the investigation activities completed for SWMU 22. Figure 17-1 shows the sampling locations.

During RFI Phase 1, 10 direct-push groundwater samples (Borings 22B01 through 22B10) were collected around the perimeter of SWMU 22 and analyzed for VOCs, SVOCs, dissolved RCRA metals, and pH.

During RFI Phase 2, four piezometers (22PZ01S through 22PZ03S and 22PZ05S) were installed around the perimeter of SWMU 22. A fifth piezometer (22PZ04S) was planned in the southeast corner of the Mill Ponds, but could not be installed due to utilities and drilling obstructions encountered in the area. In lieu of Piezometer 22PZ4S, a groundwater sample was collected from Piezometer PZ-Xa, which was installed in 1997 for the RCRA Landfill. During RFI Phase



2, groundwater samples were collected from five piezometers around the perimeter of the Mill Ponds, four direct-push borings to the east of the Mill Ponds, and one direct-push boring to the north of the Levee. The 10 RFI Phase 2 groundwater samples were analyzed for dissolved arsenic.

To characterize materials within the Mill Ponds, four water and sediment samples were collected from the ponds during RFI Phase 2. Sample locations were placed at the northern and southern ends of each pond. Mill Pond water samples were analyzed for dissolved arsenic and sediment samples were analyzed for total arsenic.

SWMU 22 is underlain by Missouri River dominated alluvial valley sediments with slag fill present beneath, and in the immediate vicinity of, the berms that surround the Mill Ponds. Groundwater beneath SWMU 22 ranges from approximately 6 to 21 feet bgs with wide seasonal fluctuations.

### **17.3 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Analytical results for the groundwater samples are presented in Tables 17-2 and 17-3. Figures 17-2 and 17-3 present the groundwater analytical result for dissolved arsenic, VOCs, and SVOCs. Table 17-6 presents the analytical results that exceeded the groundwater screening MCLs.

#### **17.3.1 Dissolved Metals and pH**

Ten groundwater samples were collected and analyzed for pH. All of the samples exhibited neutral pH values which ranged from pH 6.3 J\* to pH 7.5 J\*.

Dissolved chromium, dissolved selenium, and dissolved silver were not detected in the 10 groundwater samples collected during RFI Phase 1. Dissolved barium was detected in all 10 RFI Phase 1 groundwater samples at concentrations up to 0.54 mg/L; however, none of the dissolved barium detections exceeded the groundwater screening MCL (2 mg/L). Dissolved cadmium (0.0015 J mg/L) and dissolved mercury (0.0008 mg/L) were detected in one sample each, but did

not exceed their groundwater screening MCLs (0.005 and 0.002 mg/L, respectively). Dissolved lead was detected in seven samples at concentrations up to 0.0135 mg/L; however, none of the lead detections exceeded the groundwater screening MCL (0.015 mg/L). Therefore, the extent of detections for these dissolved metals was adequately defined by the sampling locations.

Dissolved arsenic was detected in nine of the ten RFI Phase 1 direct-push groundwater samples, five RFI Phase 2 Piezometer samples, and none of the RFI Phase 2 direct-push groundwater samples. Dissolved arsenic detections ranged from 0.02 J to 0.25 mg/L. As shown on Figure 17-2 and in Table 17-6, dissolved arsenic results exceeded the groundwater screening MCL (0.05 mg/L) for 10 of the 20 groundwater samples. The extent of dissolved arsenic was well defined to the north by Boring 22B15, which is downgradient of the Mill Ponds. The extent was also well defined to the east (Borings 22B11 through 22B14 and Piezometer PZ-Xa) of the Mill Ponds. Further sampling could not be implemented to the south (upgradient) and west of the Mill Ponds due to physical restrictions and property boundaries.

### **17.3.2 VOCs**

Ten direct-push groundwater samples were collected and analyzed for VOCs. As shown in Figure 17-3, VOCs were not detected in any of the samples. Therefore, the nature and extent of VOCs in groundwater was adequately defined by the sampling locations.

### **17.3.3 SVOCs**

Ten direct-push groundwater samples were collected and analyzed for SVOCs. As shown on Figure 17-3, SVOCs were not detected in seven of these groundwater samples. 2,4-Dimethylphenol (8.6 J  $\mu\text{g/L}$ ) was detected in the sample collected from Boring 22B01 at the northwest corner of the Mill Ponds. No MCL has been established for 2,4-dimethylphenol. BEHP (67.7 and 139  $\mu\text{g/L}$ ) was detected in samples collected from Borings 22B08 and Boring 22B10 on the western side of the Mill Ponds. As indicated on Table 17-6, both of these detections exceeded the BEHP groundwater screening MCL (6  $\mu\text{g/L}$ ). The extent of BEHP was well defined by the sampling locations except on the western side of the Mill Ponds. Further



sampling could not be implemented to the west of the Mill Ponds due to physical restrictions and property boundaries.

#### **17.4 NATURE AND EXTENT OF ARSENIC CONTAMINATION IN MILL POND WATER AND SEDIMENT**

Analytical results for the Mill Pond water and sediment samples are presented on Tables 17-4 and 17-5, respectively. Mill Pond water and sediment sample analytical results are shown on Figure 17-4.

Mill Pond sediment and water samples were collected to assess the general conditions of materials within the ponds. Dissolved arsenic was not detected in any of the Mill Pond water samples. Arsenic was detected in all four sediment samples collected from the Mill Ponds. Arsenic concentrations in the Mill Pond sediment samples ranged from 26.8 D to 47.6 D mg/Kg. As shown on Table 17-7, three of the sediment samples contained arsenic concentrations which exceeded the 20 DAF SSL (29 mg/Kg).

#### **17.5 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 22, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater and groundwater transport) and the surface pathway (surface water transport).

The nature and extent of contamination at SWMU 22 was assessed through the collection of groundwater, Mill Pond sediment, and Mill Pond water samples. In groundwater, VOCs were not detected and only limited detections of SVOCs occurred (BEHP exceeded MCLs in two samples). Dissolved metals were detected; however, only dissolved arsenic was detected at concentrations above the MCL. Based on the tendency for metals to adsorb to soil rather than migrate with groundwater flow, the neutral groundwater pH (6.3 to 7.5) at SWMU 22 (which limits the solubility of arsenic), and the limited detections of SVOCs, groundwater transport is not expected to be significant for SWMU 22. SWMU 22 is located approximately 400 feet south of the Blue River. Groundwater flow direction beneath SWMU 22 is toward the Blue River.

Mill Pond sediment samples collected contained arsenic concentrations that exceeded the 20 DAF SSL (based on soil migration to groundwater); therefore, soil transfer to groundwater could occur. However, the Ponds are clay lined, which should limit the potential for arsenic to migrate vertically through the subsurface soil to groundwater.

Mill Pond water samples did not show detections of dissolved arsenic. Based on this, the discharge of a portion of the Mill Ponds water through GSTs NPDES Outfall No. 42 to the Blue River should not provide a significant route for contaminant migration.

## **17.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted for SWMU 22.

### **17.6.1 Human Health Evaluation**

BEHP and arsenic were identified as COPCs in groundwater. Arsenic was identified as a COPC in sediment. A HHRA was conducted for SWMU 22 to evaluate potential health risks to existing and possible future on-site worker populations including temporary excavation workers. For the exposure scenarios evaluated, there were no potentially completed exposure pathways identified for arsenic in sediment and it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in groundwater at SWMU 22. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization are presented in Chapter 5.0 of Appendix X.

### **17.6.2 Ecological Evaluation**

Due to restricted access for ecological receptors and the active industrial use of the Mill Ponds, ecological receptors are not expected to be affected at SWMU 22. Therefore, an ecological risk evaluation was not conducted for SWMU 22.

## 17.7 SUMMARY

SWMU 22, located in the eastern portion of the Facility, is the active GST Mill Ponds utilized for the cooling of mill water from various on-site locations. SWMU 22 covers an area of approximately 25 acres. Groundwater samples were collected around the perimeter of the Mill Ponds and water and sediment samples were collected from within the Mill Ponds.

Ten groundwater samples around the perimeter of the Mill Ponds were collected for dissolved RCRA metals, pH, VOC, and SVOC analyses during Phase 1, and an additional 15 groundwater samples were collected for dissolved arsenic analysis during Phase 2. Groundwater pH values were all neutral (pH 6.3 J\* to 7.5 J\*). For the dissolved RCRA metals, dissolved arsenic was the only metal detected at concentrations exceeding its groundwater screening MCL. Dissolved arsenic was detected in 14 groundwater samples at concentrations ranging from 0.02 J to 0.25 mg/L, and the groundwater screening MCL (0.05 mg/L) was exceeded in 10 of the samples (see Figure 17-2). The extent of dissolved arsenic was well defined by sampling locations to the north and east of the Mill Ponds. Further sampling could not be implemented to the south and west of the Mill Ponds due to physical restrictions and property boundaries. Dissolved chromium, dissolved selenium, and dissolved silver were not detected in any of the groundwater samples. Dissolved barium, dissolved cadmium, dissolved lead and dissolved mercury were each detected in at least one groundwater sample, but concentrations of these metals were less than their respective groundwater screening MCLs.

VOCs were not detected in any of the groundwater samples. As shown on Figure 17-3, the nature and extent of VOCs in groundwater was adequately defined by the sampling locations around the perimeter of SWMU 22.

SVOCs were largely undetected in the groundwater samples. 2,4-Dimethylphenol (8.6 J  $\mu\text{g/L}$ ) and BEHP (67.7 and 139  $\mu\text{g/L}$ ) were detected in one and two groundwater samples, respectively. Both BEHP detections exceeded the groundwater screening MCL (6  $\mu\text{g/L}$ ). The extent of BEHP was well defined by the sampling locations except on the western side of the Mill Ponds (see Figure 17-3). Further sampling could not be implemented to the west of the Mill Ponds due to physical restrictions and property boundaries.

To better characterize materials within the Mill Ponds, four samples each of Mill Pond water and sediment were collected. Dissolved arsenic was not detected in any of the Mill Pond water samples. Arsenic was detected in all four Mill Pond sediment samples at concentrations ranging from 26.8 D to 47.6 D mg/Kg. As shown on Figure 17-4, three of the sediment samples contained arsenic concentrations which exceeded the 20 DAF SSL (29 mg/Kg).

Potential migration pathways at SWMU 22 include soil transfer to groundwater, groundwater transport, and surface water transport. In groundwater, dissolved arsenic and one SVOC exceeded MCLs. Based on the tendency for metals to adsorb to soil rather than migrate with groundwater flow, the neutral groundwater pH (6.3 to 7.5) at SWMU 22 (which limits the solubility of arsenic), and the limited detections of SVOCs, groundwater transport is not expected to be a significant for SWMU 22. Arsenic concentrations from Pond sediment samples exceeded the 20 DAF SSL (based on soil migration to groundwater); therefore, soil transfer to groundwater could occur. However, the Ponds are clay lined, which should limit the potential for arsenic to migrate vertically through the subsurface soil to groundwater. Mill Pond water collected did not show detections of dissolved arsenic. Based on this, the discharge of a portion of the Mill Pond water through GSTs NPDES Outfall No. 42 to the Blue River should not provide a significant route for contaminant migration.

A risk evaluation was conducted for SWMU 22. For the human health evaluation, BEHP and arsenic were identified as COPCs in groundwater and arsenic was identified as a COPC in sediment. Therefore, a HHRA was conducted to evaluate potential health risks to existing and possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, there were no potentially completed exposure pathways identified for arsenic in sediment, and no significant risk was posed by the COPCs in groundwater at SWMU 22. Due to restricted access for ecological receptors and the active industrial use of the Mill Ponds, an ecological risk evaluation was not conducted for SWMU 22.

\* \* \* \* \*

**Table 17-1**  
**SWMU 22 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis						Comments	Lab ID Number
Point	Designator				VOC	SVOC	Arsenic	Dissolved Arsenic	RCRA Metals	pH		
DIRECT-PUSH GROUNDWATER SAMPLES												
22B01	DW1	16 - 18	03/21/1997	1	X	X			X	X		D97-3447-1
22B02	DW1	22 - 24	03/21/1997	1	X	X			X	X		D97-3447-2
22B03	DW1	22 - 24	03/21/1997	1	X				X		Bottle broken upon arrival Field Duplicate	D97-3447-3
	DW1D	22 - 24	03/21/1997	1	X	X			X	X		D97-3447-4
22B04	DW1	22 - 24	03/21/1997	1	X	X			X	X		D97-3447-5
22B05	DW1	22 - 24	03/21/1997	1	X	X			X	X		D97-3447-6
22B06	DW1	22 - 24	03/21/1997	1	X	X			X	X		D97-3447-7
22B07	DW1	16.1 - 18.1	04/25/1997	1	X	X			X	X		D97-5144-1
22B08	DW1	30 - 32	03/21/1997	1	X	X			X	X	Matrix Spike Matrix Spike Duplicate	D97-3447-8
	DW1MS	30 - 32	03/21/1997	1	X	X			X			D97-3447-9
	DW1MSD	30 - 32	03/21/1997	1	X	X			X			D97-3447-10
22B09	DW1	30 - 32	03/21/1997	1	X	X			X	X		D97-3447-11
22B10	DW1	30 - 32	03/21/1997	1	X	X			X	X		D97-3447-12
22B11	DW1	8 - 12	07/10/1998	2				X				D98-4827-1
22B12	DW1	6 - 10	07/10/1998	2				X				D98-4827-2
22B13	DW1	6 - 10	07/10/1998	2				X				D98-4827-3
22B14	DW1	6 - 10	07/10/1998	2				X				D98-4827-4
22B15	DW1	6 - 10	07/10/1998	2				X				D98-4827-5
MONITORING WELL GROUNDWATER SAMPLES <sup>1</sup>												
22PZ01S	GW1	NA	07/09/1998	2				X				D98-4800-1
22PZ02S	GW1	NA	07/09/1998	2				X				D98-4800-2
22PZ03S	GW1	NA	07/09/1998	2				X				D98-4800-3
22PZ05S	GW1	NA	07/09/1998	2				X				D98-4800-4
22PZXa <sup>2</sup>	GW1	NA	07/09/1998	2				X			Matrix Spike Matrix Spike Duplicate	D98-4800-5
	GW1MS	NA	07/09/1998	2				X				D98-4800-6
	GW1MSD	NA	07/09/1998	2				X				D98-4800-7
MILL POND WATER SAMPLES												
22P01	SW1	NA	05/21/1998	2				X				D98-3868-3
22P02	SW1	NA	05/21/1998	2				X				D98-3868-5
22P03	SW1	NA	05/21/1998	2				X				D98-3868-12
22P04	SW1	NA	05/21/1998	2				X				D98-3868-11
MILL POND SEDIMENT SAMPLES												
22P01	SD1	0 - 0.5	05/21/1998	2			X				Field Duplicate	D98-3868-1
	SD1D	0 - 0.5	05/21/1998	2			X					D98-3868-2
22P02	SD1	0 - 0.5	05/21/1998	2			X					D98-3868-4
22P03	SD1	0 - 0.5	05/21/1998	2			X				Rinsate	D98-3868-6
	SD1R	0 - 0.5	05/21/1998	2			X					D98-3868-7

**Table 17-1**  
**SWMU 22 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis						Comments	Lab ID Number
Point	Designator				VOC	SVOC	Arsenic	Dissolved Arsenic	RCRA Metals	pH		
22P04	SD1	0 - 0.5	05/21/1998	2			X					D98-3868-8
	SD1MS	0 - 0.5	05/21/1998	2			X				Matrix Spike	D98-3868-9
	SD1MSD	0 - 0.5	05/21/1998	2			X				Matrix Spike Duplicate	D98-3868-10

Notes:

ft = feet

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

SVOC = Semivolatile Organic Compounds

VOC = Volatile Organic Compounds

<sup>1</sup> = Piezometer 22PZ04 could not be installed.

<sup>2</sup> = Piezometer PZ-Xa is associated with the RCRA Landfill.

**Table 17-2**  
**SWMU 22 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		22B01/DW1 3/21/1997 16 18 D97-3447-1	22B02/DW1 3/21/1997 22 24 D97-3447-2	22B03/DW1 3/21/1997 22 24 D97-3447-3	22B03/DW1D 3/21/1997 22 24 D97-3447-4 Duplicate	22B04/DW1 3/21/1997 22 24 D97-3447-5	22B05/DW1 3/21/1997 22 24 D97-3447-6	22B06/DW1 3/21/1997 22 24 D97-3447-7
<b>Volatiles</b>	UNITS							
		ND	ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	UNITS							
2,4-Dimethylphenol	ug/L	8.6 J	10 U	NA	10 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	ug/L	10 U	10 U	NA	10 U	10 U	10 U	10 U
<b>Total Detected SVOCs</b>	UNITS							
<b>Total Semi-Volatiles</b>	ug/L	8.6	ND	NA	ND	ND	ND	ND
<b>Metals, Dissolved</b>	UNITS							
Arsenic, Dissolved	mg/L	0.02 J	0.25	0.05 J	0.05 J	0.19	0.23	0.1 J
Barium, Dissolved	mg/L	0.162	0.54	0.474	0.481	0.397	0.478	0.371
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0015 J
Lead, Dissolved	mg/L	0.0031	0.011	0.0039	0.003 U	0.003 U	0.0135	0.0107
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0008	0.0002 U	0.0002 U	0.0002 U	0.0002 U
<b>Water Quality Parameters</b>	UNITS							
pH	SU	7.5 J*	6.3 J*	NA	7.1 J*	6.4 J*	6.6 J*	6.6 J*

LEGEND: B - Detected in the associated laboratory method blank F - Detected in the associated equipment rinsate blank J - Qualified as estimated by the laboratory  
R - Qualified as unusable in the QC evaluation T - Detected in associated trip blank U - Qualified as undetected by the laboratory  
NA - Not Analyzed ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 17-2**  
**SWMU 22 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		22B07/DW1 4/25/1997 16.1 18.1 D97-5144-1	22B08/DW1 3/21/1997 30 32 D97-3447-8	22B09/DW1 3/21/1997 30 32 D97-3447-11	22B10/DW1 3/21/1997 30 32 D97-3447-12	22B11/DW1 7/10/1998 8 12 D98-4827-1	22B12/DW1 7/10/1998 6 10 D98-4827-2	22B13/DW1 7/10/1998 6 10 D98-4827-3
<b>Volatiles</b>	UNITS							
		ND	ND	ND	ND	NA	NA	NA
<b>Semivolatiles</b>	UNITS							
2,4-Dimethylphenol	ug/L	11 U	10 U	10 U	10 U	NA	NA	NA
Bis(2-ethylhexyl)phthalate	ug/L	11 U	139	10 U	67.7	NA	NA	NA
<b>Total Detected SVOCs</b>	UNITS							
<b>Total Semi-Volatiles</b>	ug/L	ND	139	ND	67.7	NA	NA	NA
<b>Metals, Dissolved</b>	UNITS							
Arsenic, Dissolved	mg/L	0.0784	0.04 J	0.1 U	0.05 J	0.01 U	0.01 U	0.01 U
Barium, Dissolved	mg/L	0.361	0.111	0.267	0.436	NA	NA	NA
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	NA	NA	NA
Lead, Dissolved	mg/L	0.003 U	0.003 U	0.0114	0.0078	NA	NA	NA
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	NA	NA
<b>Water Quality Parameters</b>	UNITS							
pH	SU	6.5 J*	6.7 J*	6.9 J*	6.9 J*	NA	NA	NA

LEGEND: B - Detected in the associated laboratory method blank F - Detected in the associated equipment rinsate blank J - Qualified as estimated by the laboratory  
R - Qualified as unusable in the QC evaluation T - Detected in associated trip blank U - Qualified as undetected by the laboratory  
NA - Not Analyzed ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 17-2**  
**SWMU 22 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		22B14/DW1	22B15/DW1
Date Sampled:		7/10/1998	7/10/1998
Sample Depth From:		6	6
Sample Depth To:		10	10
Laboratory Number:		D98-4827-4	D98-4827-5
Sample Type:			
<b>Volatiles</b>	<b>UNITS</b>		
		NA	NA
<b>Semivolatiles</b>	<b>UNITS</b>		
2,4-Dimethylphenol	ug/L	NA	NA
Bis(2-ethylhexyl)phthalate	ug/L	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>		
<b>Total Semi-Volatiles</b>	<b>ug/L</b>	NA	NA
<b>Metals, Dissolved</b>	<b>UNITS</b>		
Arsenic, Dissolved	mg/L	0.01 U	0.01 U
Barium, Dissolved	mg/L	NA	NA
Cadmium, Dissolved	mg/L	NA	NA
Lead, Dissolved	mg/L	NA	NA
Mercury, Dissolved	mg/L	NA	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>		
pH	SU	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 17-3**  
**SWMU 22 Phase 2 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		22PZ01S/GW1	22PZ02S/GW1	22PZ03S/GW1	22PZ05S/GW1	22PZXA/GW1
Date Sampled:		7/9/1998	7/9/1998	7/9/1998	7/9/1998	7/9/1998
Laboratory Number:		D98-4800-1	D98-4800-2	D98-4800-3	D98-4800-4	D98-4800-5
Sample Type:						
<b>Metals, Dissolved</b>	<b>UNITS</b>					
Arsenic, Dissolved	mg/L	0.084	0.174	0.025	0.102	0.025

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 17-4**  
**SWMU 22 Phase 2 Mill Pond Water Results**  
**Armco Kansas City Facility**

Sample Point:		22P01/SW1	22P02/SW1	22P03/SW1	22P04/SW1
Date Sampled:		05/21/1998	05/21/1998	05/21/1998	05/21/1998
Laboratory Number:		D98-3868-3	D98-3868-5	D98-3868-12	D98-3868-11
Sample Type:					
<b>Metals, Dissolved</b>	<b>UNITS</b>				
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	0.01 U	0.01 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 17-5**  
**SWMU 22 Phase 2 Mill Pond Sediment Results**  
**Armco Kansas City Facility**

Sample Point:		22P01/SD1	22P01/SD1D	22P02/SD1	22P03/SD1	22P04/SD1
Date Sampled:		05/21/1998	05/21/1998	05/21/1998	05/21/1998	05/21/1998
Sample Depth From:		0	0	0	0	0
Sample Depth To:		0.5	0.5	0.5	0.5	0.5
Laboratory Number:		D98-3868-1	D98-3868-2	D98-3868-4	D98-3868-6	D98-3868-8
Sample Type:			Duplicate			
Metals, Total	UNITS					
Arsenic, Total	mg/Kg	32.5 D	39.6 D	26.8 D	47.6 D	45.6 D

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 17-6**  
**SWMU 22 Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL (mg/L)	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result (mg/L)
<b>Skinner's Semivolatiles</b>	<b>(µg/kg)</b>			<b>(µg/kg)</b>
bis(2-ethylhexyl)phthalate	6	22B08 / DW1	30 - 32	139
		22B10 / DW1	30 - 32	67.7
<b>Metals</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Arsenic, Dissolved	0.05	22B02 / DW1	22 - 24	0.25
		22B03 / DW1	22 - 24	0.05 J
		22B03 / DW1D	22 - 24	0.05 J
		22B04 / DW1	22 - 24	0.19
		22B05 / DW1	22 - 24	0.23
		22B06 / DW1	22 - 24	0.1 J
		22B07 / DW1	16.1 - 18.1	0.0784
		22B10 / DW1	30 - 32	0.05 J
		22PZ01S / GW1	NA	0.084
		22PZ02S / GW1	NA	0.174
		22PZ05S / GW1	NA	0.102

**Notes:**

ft = feet

J = Estimated value; concentration below practical quantitation limit.

MCL = Maximum Contaminant Level

**Table 17-7**  
**SWMU 22 Mill Pond Sediment Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/Kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/Kg)
Arsenic, Total	29	22P01 / SD1	0 - 0.5	32.5 D
		22P01 / SD1D	0 - 0.5	39.6 D
		22P03 / SD1	0 - 0.5	47.6 D
		22P04 / SD1	0 - 0.5	45.6 D

Notes:

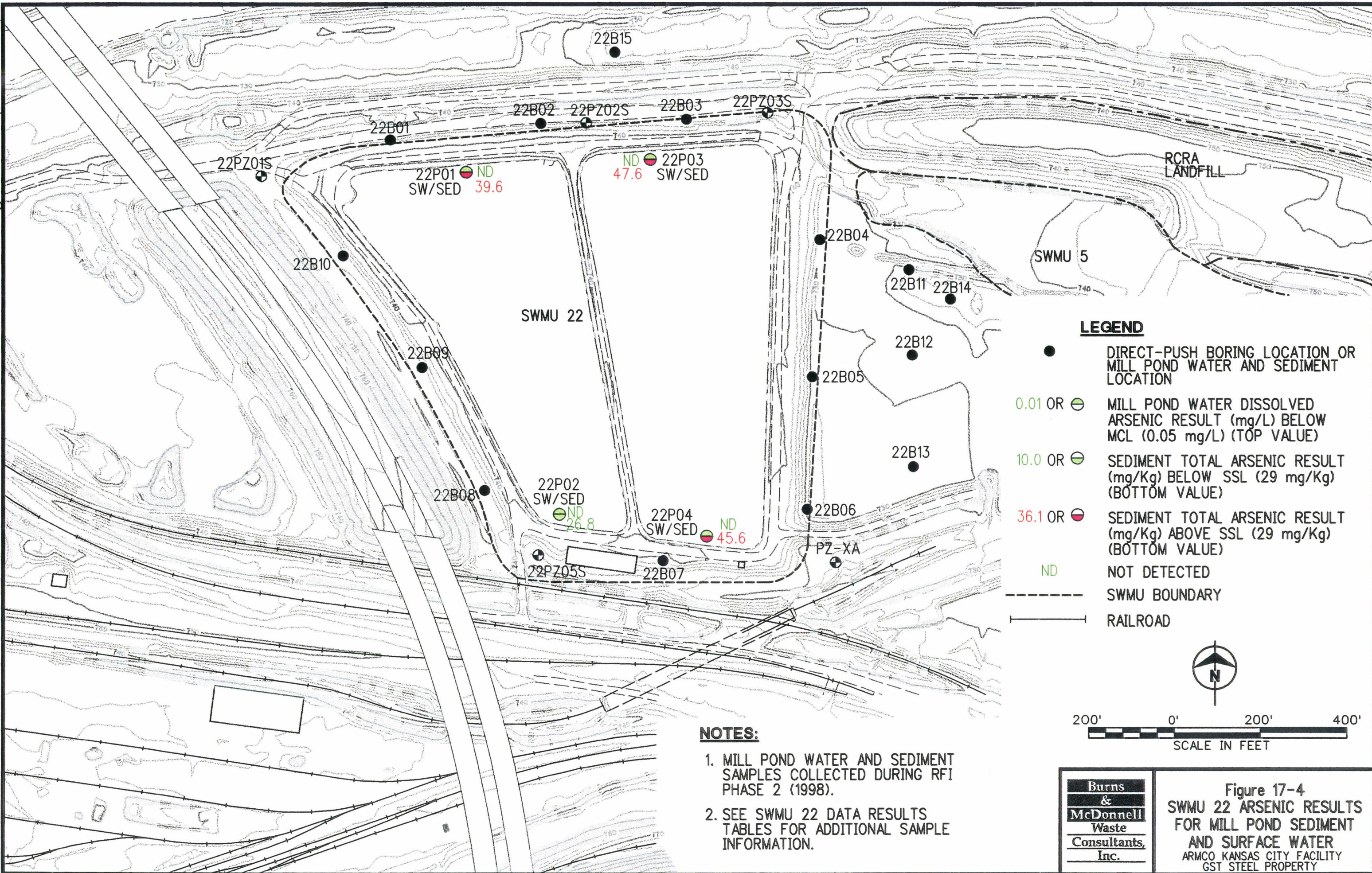
D = Sample was diluted prior to analysis

DAF = Dilution Attenuation Factor

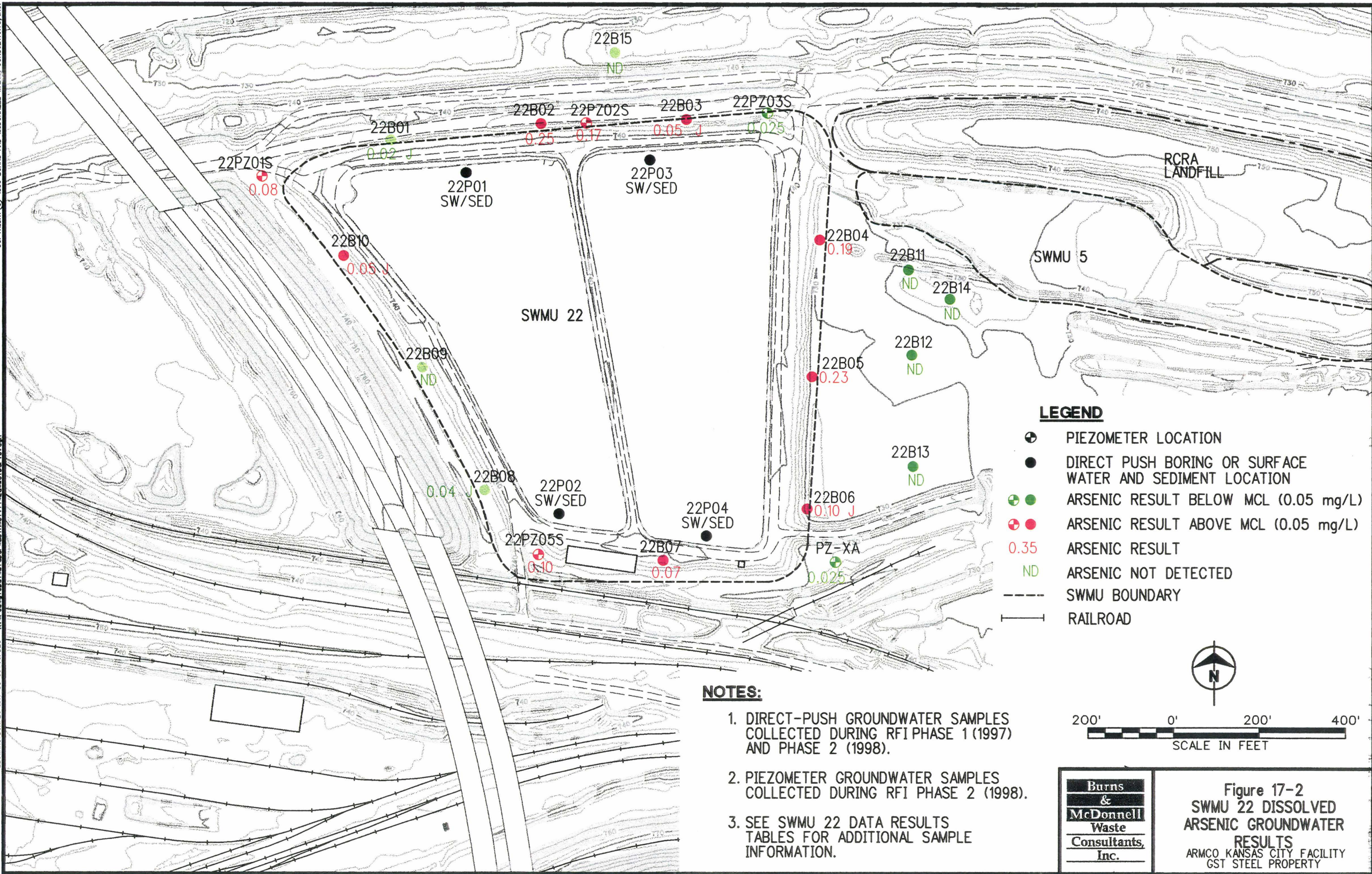
ft = feet

SSL = Soil Screening Level

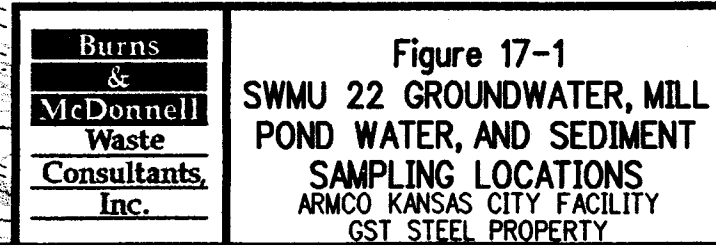




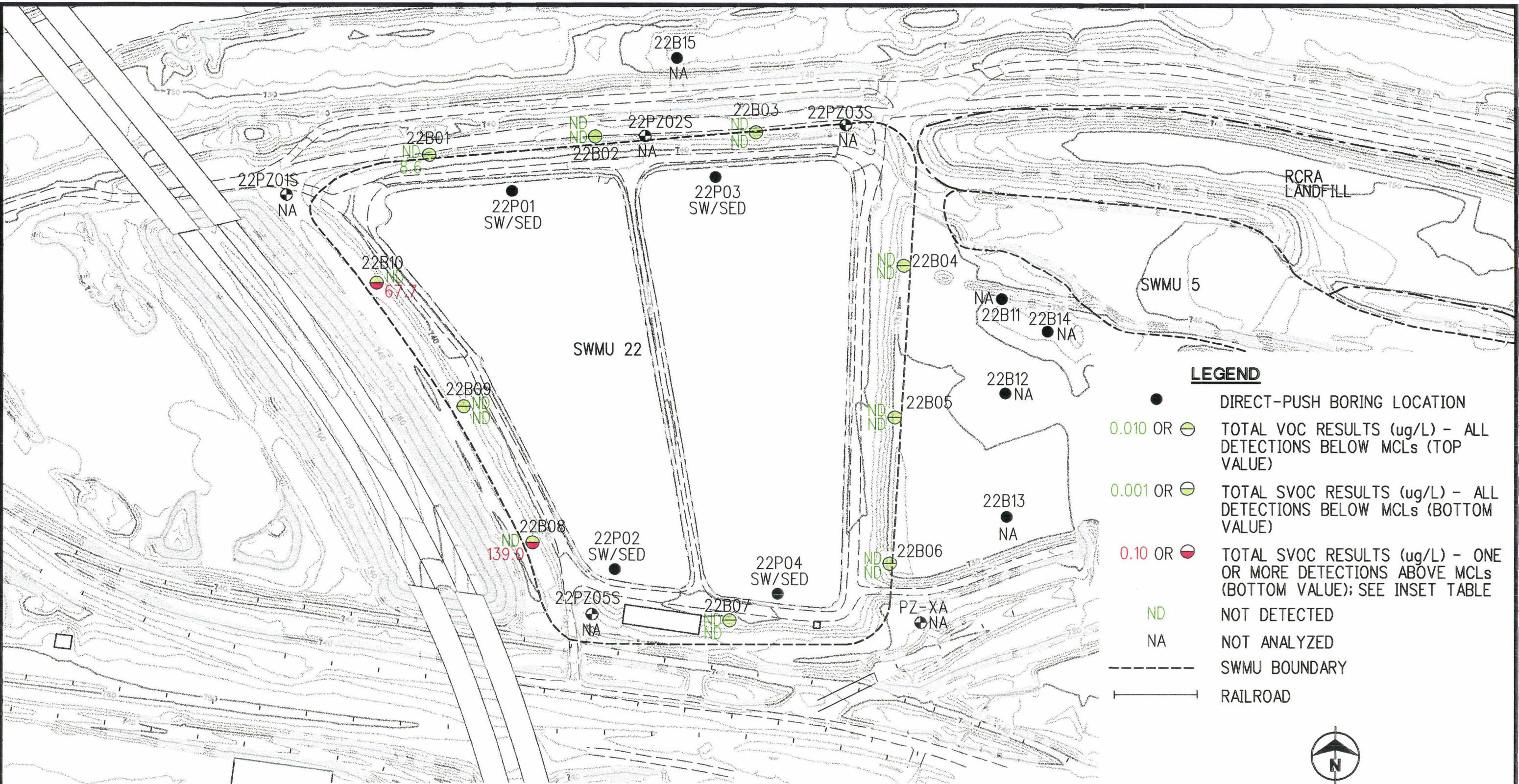












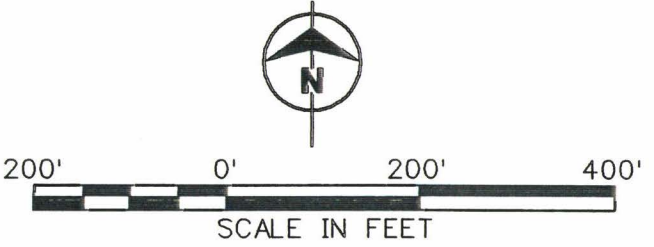
SVOC GROUNDWATER DETECTIONS ABOVE MCLs			
PARAMETER	MCL (ug/L)	SAMPLE	SAMPLE RESULT (ug/L)
BIS(2-ETHYLHEXYL)PHTHALATE	6	22B08/ DW1	139
		22B10/ DW1	67.7

**NOTES:**

1. DIRECT-PUSH GROUNDWATER SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
2. SEE SWMU 22 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.

**LEGEND**

- DIRECT-PUSH BORING LOCATION
- 0.010 OR ● TOTAL VOC RESULTS (ug/L) - ALL DETECTIONS BELOW MCLs (TOP VALUE)
- 0.001 OR ● TOTAL SVOC RESULTS (ug/L) - ALL DETECTIONS BELOW MCLs (BOTTOM VALUE)
- 0.10 OR ● TOTAL SVOC RESULTS (ug/L) - ONE OR MORE DETECTIONS ABOVE MCLs (BOTTOM VALUE); SEE INSET TABLE
- ND NOT DETECTED
- NA NOT ANALYZED
- SWMU BOUNDARY
- RAILROAD



**Burns & McDonnell Waste Consultants, Inc.**

**Figure 17-3**  
**SWMU 22 TOTAL VOC AND TOTAL SVOC GROUNDWATER RESULTS**  
ARMCO KANSAS CITY FACILITY  
GST STEEL PROPERTY



**SWMU 24**  
**WASTE HYDRAULIC LUBRICATING OIL STORAGE TANKS**  
**(ARMCO AND KANSAS CITY TERMINAL RAILWAY PROPERTY)**

## **18.0 SWMU 24 – WASTE HYDRAULIC LUBRICATING OIL STORAGE TANKS**

### **18.1 SWMU BACKGROUND**

#### **18.1.1 Description of SWMU**

The former Waste Hydraulic and Lubricating Oil Storage Tanks (SWMU 24), located on Armco and KCT property (Figure 1-2), functioned between 1975 and 1993 as a waste oil collection system for the entire Facility. Waste oil of various types was brought to the area in drummed containers or 600-gallon waste oil "tote boxes". Until 1991, the waste oil from SWMU 24 was incorporated into the heating oil supply; however, after November 1991, waste oil was sent off site for fuel blending. The defined SWMU area is approximately 1 acre in size.

When the SWMU was removed from service in 1993, its components were cleaned and subsequently dismantled and removed. The two ASTs at SWMU 24 were cut up and recycled in 1996.

Various records indicated that for a brief time in the 1980s, 1,1,1-TCA might have been mixed into the waste oil, which was subsequently mixed with the fuel oil and utilized in the boiler furnaces (AOC 4). There was no mechanism at the Boiler Furnace Area to incorporate the addition of any material to the fuel oil supply. If 1,1,1-TCA was added to the fuel oil system, it most likely would have been added in the waste oil area.

Based on the types of materials handled at SWMU 24, the primary constituents of potential concern were petroleum hydrocarbons and heavy metals associated with the waste oil, and VOCs.

As reported to USEPA and MDNR in a letter dated March 9, 1999, Armco sold a portion of its property, totaling less than one (1) acre, to KCT for construction of an overhead Railroad Bridge known as the Flyover Project to relieve transportation congestion and public safety issues in the area. As indicated on Figure 18-1, this parcel of land contained a portion of SWMU 24. As part

of the Flyover Project, the low-lying area at the center of SWMU 24 has been partially filled by KCT.

SWMU 24 was designated in the Permit as an IM SWMU. IM activities were completed as described in Section 18.2.

### **18.1.2 Release Potential**

No documented spills are known to have occurred at this location. Stained soils have been identified at this location. The low area surrounding the two waste oil ASTs provided a form of secondary containment for the waste oil stored there. Although there was no secondary containment around the drums or hoppers, releases in those areas would have flowed to the low area around the ASTs.

The SWMU was removed from service in 1993, and any remaining waste oil in the area was removed at that time. Therefore, there is no ongoing risk of a release of waste oil to the environment. The primary release potential for SWMU 24 was to the surrounding surface and subsurface soils which could have been impacted by releases of waste oil to the ground surface.

## **18.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of surface soil, subsurface soil, and groundwater samples. Table 18-1 presents a summary of the investigation activities for SWMU 24, and Figure 18-1 presents the sampling locations.

### **18.2.1 Interim Measures Activities**

Eight surface soil samples were collected from four sampling grids (Grids 24G01 through 24G04) located in the low area in the center of SWMU 24 where ASTs were formerly located. As shown on Figure 18-1, this low area is approximately 10 feet below surrounding grade to the west, south, and east and the height of the slag berm to the north. Each surface soil sample was a composite of four aliquots collected across a sampling grid. Samples were collected from each

grid at two depth intervals (0 to 6 and 6 to 12 inches bgs). Surface soil samples were analyzed for VOCs, PAHs, TPH, and RCRA metals.

Subsurface soil samples were collected from six exploratory trenches (Trench 24T01 through 24T06) completed across the SWMU 24 area (see Figure 18-1) and analyzed for VOCs, PAHs, TPH, and RCRA metals. Trenches 24T01, 24T05, and 24T06 were located near the center of SWMU 24 where the majority of the waste oil handling occurred. Trenches 24T02 and 24T04 were located in the western portion and Trench 24T03 was located in the eastern portion of SWMU 24 in order to define the horizontal extent of constituents.

Perched groundwater seeped into Trench 24T06, and a single unfiltered groundwater sample was collected and analyzed for VOCs, PAHs, TPH, and total RCRA metals.

#### **18.2.2 RFI Activities**

During RFI Phase 1, six soil borings (Boring 24B01 through 24B06) were advanced and samples were collected from two to four depth intervals (0 to 4, 4 to 8, 8 to 12, and/or 12 to 16 feet bgs). Fourteen subsurface soil samples were analyzed for PAHs, RCRA metals, and pH. In addition, the samples collected from Boring 24B04 were analyzed for TPH. Perched groundwater with elevated PID readings was encountered in Boring 24B04, and a groundwater sample was collected and analyzed for VOCs, PAHs, TPH, and dissolved RCRA metals.

To further define the horizontal and vertical extent of subsurface soil constituents, two exploratory trenches (Trenches 24T07 and 24T08) were installed during RFI Phase 2 to the east and west, respectively, of SWMU 24. Four samples were collected from each of the trenches and analyzed in the field for lead using XRF. The samples were then sent to the analytical laboratory and analyzed for PAHs, RCRA metals, and pH.

To further define the horizontal extent of VOCs in groundwater, direct-push groundwater samples were collected from eight locations (Borings 06B06A, 06B07A, 06B10A, 06B11A, and 24B07 through 24B10) during RFI Phase 2 and analyzed for VOCs. Samples were collected

from the upper 10 feet of the water table at depths from 24 to 42 feet bgs. Borings identified as "06B\_A" were installed adjacent to RFI Phase 1 boring locations (e.g., Boring 06B06) at SWMU 6, which is located directly north of SWMU 24.

Berms of gravel to cobble sized slag fill surround the former AST pit at SWMU 24. Exploratory trenches were utilized to sample this material since it was impenetrable by direct-push or hollow-stem auger boring methods. On the floor of the AST pit, there is a 1 to 2 feet layer of pea gravel-size slag fill underlain by silty clay. Direct-push borings were able to penetrate through this material. Perched groundwater was occasionally encountered above the slag fill/silty clay contact as a result of the lower permeability (and resultant lower infiltration rate) of the silty clay.

### **18.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Tables 18-2 through 18-5 present the analytical results of the soil samples collected from SWMU 24. Figures 18-2, 18-3, and 18-4 show the soil analytical results for RCRA metals, VOCs, and PAHs, respectively. TPH results are presented in Appendix U.

#### **18.3.1 Metals and pH**

During RFI Phase 1, 14 subsurface soil samples were collected from direct-push boring locations and analyzed for pH. As shown on Table 18-3, pH values were neutral (pH 7.8) to slightly basic (pH 9.3). There were no notable trends in changes in pH values with sample depth or location.

Figure 18-2 presents the soil analytical results for metals at SWMU 24. Eight surface soil, 14 direct-push subsurface soil, and 29 trench subsurface soil samples were collected and analyzed for RCRA metals. Table 18-8 presents the soil results that exceeded the screening limits at SWMU 24. Each of the RCRA metals was detected in at least one sample. However, none of the barium, mercury, or silver detections exceeded the 20 DAF SSLs (1,600, 2, and 34 mg/Kg, respectively); the highest concentrations for each of these metals were 780, 0.357, and 1.56 mg/Kg, respectively.

Arsenic was not detected in any of the surface soil samples, but was detected in 9 of the 29 trench soil samples, and all 14 of the direct-push soil boring samples. The highest concentration of arsenic (56.4 mg/Kg) was detected in the shallowest sample (0 to 4 feet bgs) collected from Boring 24B05 which was placed in the low area where the ASTs were formerly located. This value was the only detection that exceeded the 20 DAF SSL for arsenic (29 mg/Kg).

Chromium was detected in all of the soil samples collected at SWMU 24. The highest concentration of chromium (3,890 F mg/Kg) was detected in the shallowest sample (0 to 5 feet bgs) collected from Trench 24T02 in the central portion of the sampling area. This value was the only detection that exceeded the soil screening value for chromium of 3,540 mg/Kg (based on slag samples).

Cadmium was detected in all but one of the soil samples collected at SWMU 24. The 20 DAF SSL for cadmium (8 mg/Kg) was exceeded in all of the surface soil samples, two of the soil boring samples, and 15 of the trench soil samples. These exceedences ranged from 9.1 to 55.1 FJ\* mg/Kg and were located in the central portion of the sampling area.

Lead was detected in all but two of the samples collected at SWMU 24. The 20 DAF SSL for lead (400 mg/Kg) was exceeded in half of the surface soil samples, two of the soil boring samples, and six of the trench soil samples. These exceedences ranged from 409 J\* to 1,730 mg/Kg and were located in the central portion of the sampling area.

Selenium was detected in one trench sample and five of the soil boring samples. Selenium detections ranged from 0.9 J to 13.5 mg/Kg. The 20 DAF SSL for selenium (5 mg/Kg) was exceeded in the samples collected from the uppermost soil interval (0 to 4 feet bgs) at direct-push Borings 24B02 and 24B05 which were placed in the low area where the ASTs were formerly located.

As shown on Figure 18-2, the vertical and horizontal extent of arsenic, chromium, cadmium, lead, and selenium were adequately defined by the soil sampling locations within and/or surrounding the perimeter of SWMU 24.



### **18.3.2 VOCs**

Eight surface soil and 21 trench soil samples were collected and analyzed for VOCs during the IM investigation. VOCs were not detected in any of the soil samples collected at SWMU 24. As shown on Figure 18-3, the nature and extent of VOC detections was adequately characterized by the sampling locations.

### **18.3.3 PAHs**

Figure 18-4 presents the soil analytical results for PAHs in soil at SWMU 24. Eight surface soil, 14 direct-push soil boring, and 29 trench soil samples were collected and analyzed for PAHs. Table 18-8 presents the samples with PAH detections that exceeded their 20 DAF SSLs.

With the exception of the samples collected from surface soil Grid 24G01, PAHs were largely not detected in the surface soil samples. However, the surface soil sample collected from 0.5 to 1 foot bgs at Grid 24G01 had detections of benzo(a)anthracene (7.13 mg/Kg) and benzo(b)fluoranthene (11.4 mg/Kg) that exceeded the 20 DAF SSLs (2 and 5 mg/Kg, respectively). Total PAH concentrations ranged from 0.701 to 21.804 mg/Kg in the samples collected from the uppermost depth interval (0 to 4 feet bgs) from the direct-push borings, and benzo(a)anthracene (2.02 DJ mg/Kg) was detected at a concentration that slightly exceeded the 20 DAF SSL (2 mg/Kg) in the sample collected from the uppermost depth interval (0 to 4 feet bgs) at Boring 24B05. No exceedences of 20 DAF SSLs were noted for PAHs in samples collected below 4 feet bgs. As shown on Figure 18-4, the horizontal and vertical extent of PAHs in soils were well defined by sampling locations in the immediate area.

## **18.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Tables 18-6 and 18-7 present the analytical results of the groundwater samples collected from SWMU 24. Figure 18-5 show the groundwater analytical results for VOCs. TPH results are presented in Appendix U.

#### **18.4.1 Metals and pH**

During the IM investigation, perched groundwater seeped into Trench 24T06, and a single unfiltered groundwater sample was collected and analyzed for total RCRA metals. Barium, cadmium, chromium, lead, and mercury were detected in this groundwater sample; however only cadmium (0.0333 mg/L) and lead (0.768 mg/L) were detected at concentrations that exceeded their groundwater screening MCLs (0.005 and 0.015 mg/L, respectively). It is likely that these groundwater exceedences were caused by particulate matter which was suspended in the sample rather than dissolved metals present in the groundwater.

During RFI Phase 1 activities in the fall of 1997, perched groundwater was also encountered in Boring 24B04 at 2.5 to 5.5 feet bgs. A groundwater sample was collected and analyzed for dissolved RCRA metals and pH. Dissolved barium (0.0699 mg/L) and dissolved arsenic (0.02 mg/L) were the only metals detected in this groundwater sample, and neither detection exceeded its groundwater screening MCL (2 and 0.05 mg/L, respectively). A slightly basic pH value (9.5) was noted in this groundwater sample.

#### **18.4.2 VOCs**

Ten groundwater samples were collected and analyzed for VOCs. Figure 18-5 shows the analytical results for the VOCs in groundwater. VOCs were not detected in five of the groundwater samples, and total VOC detections ranged from 5.39 to 682.24 µg/L. The groundwater sample collected from Boring 24B04 contained detections of cis-1,2-DCE (295 µg/L), TCE (149 µg/L), and vinyl chloride (5.34 µg/L) that exceeded their groundwater screening MCLs (70, 5, and 2 µg/L, respectively). This sample was collected from perched groundwater (2.5 to 5.5 feet bgs) seeping into the borehole during installation. No other exceedences of groundwater screening MCLs were noted in samples collected from the saturated zone (24 to 42 feet bgs). Therefore, the extent of VOC detections in groundwater was adequately defined by sampling locations which surrounded Boring 24B04.

### **18.4.3 PAHs**

Two groundwater samples (Trench groundwater sample 24T06/GW1 and direct-push groundwater sample 24B04/DW1) were collected and analyzed for PAHs. Since PAHs were not detected in either of these samples, the nature and extent of PAHs in groundwater was adequately defined at SWMU 24.

## **18.5 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 24, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater and groundwater transport), the surface pathway (storm water runoff), and air pathways (volatilization and airborne dust).

The nature and extent of contamination at SWMU 24 was assessed through the collection of surface soil, subsurface soil, and groundwater samples. Metals were detected in soil throughout the SWMU 24 area and 20 DAF SSL exceedences (based on soil migration to groundwater) occurred from the surface to depths of 15 feet bgs (approximate deepest elevation 735 feet above MSL). Soil PAH exceedences were limited to a small area in the middle of the SWMU and occurred from the surface to a depth of 4 feet bgs (approximate elevation 738 feet above MSL). VOCs were not detected in any of the soil samples. Based on the data, soil transfer to groundwater could occur. The tendency for metals and PAHs to strongly adsorb to soil and the slightly basic soil pH values (7.8 to 9.3) at SWMU 24 should limit the potential for most vertical migration in soil.

VOCs were present in the groundwater at SWMU 24. However, the one sample with detections above MCLs was collected from perched groundwater (Boring 24B04) encountered at a shallow depth (2.5 feet bgs; approximate elevation 739 feet above MSL) above the saturated zone. Dissolved metals were either not-detected or detected at concentrations less the MCLs in this perched groundwater sample. At SWMU 24, the saturated zone was typically encountered between 24 to 40 feet bgs (approximate elevations ranging from 708 [deepest] to 722 [shallowest] feet above MSL). VOCs were either not-detected or detected in concentrations below MCLs in groundwater samples collected from the saturated zone. SWMU 24 is located

approximately 500 ft east of the Blue River and groundwater is expected to flow toward the Blue River in a west-northwest direction. VOCs are expected to degrade as they migrate in the direction of groundwater flow. Metals and PAHs are expected to strongly adsorb to soil rather than migrate with groundwater flow. Although groundwater transport is a potential migration pathway, it is not expected to be significant based on the groundwater data.

Surface cover material at SWMU 24 is primarily slag fill, and the former tank location has been partially backfilled as part of KCT's Flyover Project. Storm water runoff at SWMU 24 ponds and infiltrates in low-lying areas in the immediate SWMU area; therefore, storm water runoff should not provide a significant route for contaminant migration. Surface soil particulate (dust) could become airborne; however, airborne dust transport is not expected to be a significant migration pathway due to the partial backfill at the former tank locations. VOCs in the subsurface may partition to the gas phase and migrate to the air pathway. However, based on the limited areas of VOCs, constituent migration via volatilization to the air pathway is not expected to be significant for this area.

## **18.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 24.

### **18.6.1 Human Health Evaluation**

SVOCs and metals were identified as COPCs in both surface and subsurface soil. Groundwater samples from perched water zones as opposed to the saturated zone were not considered part of the groundwater medium for purposes of the HHRA. Benzene was the only COPC identified in groundwater. A HHRA and lead modeling were conducted for SWMU 24 to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in soil or groundwater at SWMU 24. Assumptions and variables used in risk

calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.

### **18.6.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 24. Therefore, an ecological risk evaluation was not conducted for SWMU 24.

## **18.7 SUMMARY**

SWMU 24, located in the western portion of the Facility, is a former waste oil collection system and consisted of two ASTs. The defined SWMU area is approximately 1 acre in size. Surface soil, subsurface soil, and groundwater samples were collected at SWMU 24. Figures 18-2 through 18-4 present the soil analytical results for metals, Total VOCs, and Total PAHs, respectively. Figure 18-5 presents the groundwater analytical results for Total VOCs.

Surface soil and subsurface soil samples were collected for RCRA metals, pH, VOCs, PAHs, and/or TPH. Subsurface soil samples were collected from direct-push borings and exploratory trenches, and surface soil samples were collected from the former tank location. Soil pH values were neutral to slightly basic (pH 7.8 to 9.3) in the 14 samples analyzed. A total of 51 surface soil and subsurface soil samples were analyzed for RCRA metals and PAHs. Cadmium and lead were detected throughout the SWMU area at concentrations exceeding their 20 DAF SSLs (8 and 400 mg/Kg, respectively), and extended to 15 feet bgs. The highest concentrations of cadmium and lead were 55.1 FJ\* and 1,730 mg/Kg, respectively. One detection each of arsenic and chromium and two detections of selenium exceeded 20 DAF SSLs. One detection each of the PAH compounds benzo(a)anthracene (7.13 mg/Kg), benzo(b)fluoranthene (11.4 mg/Kg), and benzo(a)anthracene (2.02 DJ mg/Kg) exceeded 20 DAF SSLs (2, 5, and 2 mg/Kg, respectively). These limited exceedences of arsenic, selenium, and PAHs occurred primarily in a small area in the immediate vicinity of the former tank location and extended no deeper than 5 feet bgs. VOCs were analyzed for in 29 surface and subsurface soil samples; however, VOCs were not detected.

Groundwater samples were collected for pH, RCRA metals, VOCs, and/or PAHs. RCRA metals analyses were performed on perched groundwater samples collected from Trench 24T06 (unfiltered therefore analyzed for total metals) and Boring 24B04 (dissolved metals). The unfiltered sample from Trench 24T06 had detections of cadmium and lead that exceeded groundwater screening MCLs; however, it is likely these were caused by particulate matter suspended in the sample rather than dissolved metals present in the groundwater. In the sample from Boring 24B04, dissolved metals detections were below groundwater screening MCLs. The groundwater pH in this sample was slightly basic (pH 9.5). VOCs were detected in five of the ten samples collected. VOC exceedences of MCLs occurred in a sample collected from perched groundwater encountered in the immediate vicinity of the former tank location (Boring 24B04), and had detections of cis-1,2-DCE (295 µg/L), TCE (149 µg/L), and vinyl chloride (5.34 µg/L) that exceeded the groundwater screening MCLs (70, 5, and 2 µg/L, respectively). The horizontal extent of VOCs was defined by the nine surrounding groundwater samples collected from the saturated zone, which all contained non-detect or concentrations below MCLs of VOCs. Two groundwater samples were analyzed for PAHs; however, no PAHs were detected.

Potential migration pathways at SWMU 24 include soil transfer to groundwater, groundwater transport, storm water runoff, volatilization to the air, and airborne dust migration. Soil detections of PAHs and metals exceeded 20 DAF SSLs (based on soil migration to groundwater), thus indicating that soil transfer to groundwater could occur. VOCs were not detected in soil. The tendency for metals and PAHs to strongly adsorb to soil and the typical slightly basic to basic soil pH conditions at the Facility are expected to limit vertical migration of metals in soil.

Groundwater samples contained detections of VOCs. However, VOCs were primarily detected in the groundwater sample collected from the perched groundwater, and VOCs were either non-detect or detected in concentrations below MCLs in groundwater samples collected from the saturated zone. VOCs are expected to degrade as they migrate in the direction of groundwater flow. Although groundwater transport is a potential migration pathway for SWMU 24, it is not expected to be significant based on the groundwater data.

Storm water runoff ponds and infiltrates in low-lying areas in the immediate SWMU 24 area. The area has been partially backfilled as part of KCT's Flyover Project, which should limit airborne dust migration of surface soil particulate. The limited detections of VOCs in the subsurface soil have the potential to partition to the gas phase and migrate to and via the air pathway; however this pathway is not expected to be significant.

A risk evaluation was conducted for SWMU 24. For the human health evaluation, COPCs identified included metals and PAHs in surface and subsurface soil, and benzene in groundwater. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil or groundwater at SWMU 24 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 24.

\* \* \* \* \*

**Table 18-1**  
**SWMU 24 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis					Comments	Lab ID Number
Point	Designator					VOC	PAH	TPH	RCRA Metals	pH		
INTERIM MEASURES COMPOSITE GRID SURFACE SOIL SAMPLES												
24G01	SR1	0 - 0.5	10/30/96	IM		X	X	X	X		Field Duplicate	D96-12383-1
	SR2	0.5 - 1	10/30/96	IM		X	X	X	X			D96-12383-2
	SR2D	0.5 - 1	10/30/96	IM		X	X	X	X			D96-12383-3
24G02	SR1	0 - 0.5	10/30/96	IM		X	X	X	X		Matrix Spike Matrix Spike Duplicate	D96-12383-4
	SR1MS	0 - 0.5	10/30/96	IM		X	X		X			D96-12383-5
	SR1MSD	0 - 0.5	10/30/96	IM		X	X		X			D96-12383-6
	SR2	0.5 - 1	10/30/96	IM		X	X	X	X			D96-12383-7
24G03	SR1	0 - 0.5	10/30/96	IM		X	X	X	X		Rinsate	D96-12383-8
	SR1R		10/30/96	IM		X			X			D96-12383-9
	SR2	0.5 - 1	10/30/96	IM		X	X	X	X			D96-12383-10
24G04	SR1	0 - 0.5	10/30/96	IM		X	X	X	X			D96-12383-11
	SR2	0.5 - 1	10/30/96	IM		X	X	X	X			D96-12383-12
DIRECT-PUSH SUBSURFACE SOIL SAMPLES												
24B01	DP1	0 - 4	9/10/97	1			X		X	X	Rinsate	D97-11023-1
	DP2	6 - 10	9/10/97	1			X		X	X		D97-11023-2
	DP2R		9/10/97	1			X		X			D97-11023-3
24B02	DP1	0 - 4	9/10/97	1			X		X	X	Field Duplicate	D97-11023-4
	DP2	4 - 8	9/10/97	1			X		X	X		D97-11023-5
	DP2D	4 - 8	9/10/97	1			X		X	X		D97-11023-6
24B03	DP1	0 - 4	9/10/97	1			X		X	X	Matrix Spike Matrix Spike Duplicate	D97-11023-7
	DP1MS	0 - 4	9/10/97	1			X		X			D97-11023-8
	DP1MSD	0 - 4	9/10/97	1			X		X			D97-11023-9
	DP2	4 - 8	9/10/97	1			X		X	X		D97-11023-10
24B04	DP1	0 - 4	9/10/97	1			X	X	X	X		D97-11023-12
	DP2	4 - 8	9/10/97	1			X	X	X	X		D97-11023-13
24B05	DP1	0 - 4	9/10/97	1			X		X	X		D97-11023-14
	DP2	4 - 8	9/10/97	1			X		X	X		D97-11023-15
24B06	DP1	0 - 4	9/10/97	1			X		X	X		D97-11023-16
	DP2	4 - 8	9/10/97	1			X		X	X		D97-11023-17
	DP3	8 - 12	9/10/97	1			X		X	X		D97-11023-18
	DP4	12 - 16	9/10/97	1			X		X	X		D97-11023-19
INTERIM MEASURES TRENCH SOIL SAMPLES												
24T01	SB1	0 - 5	11/7/96	IM		X	X	X	X		Field Duplicate	D96-12760-5
	SB2	5 - 10	11/7/96	IM		X	X	X	X			D96-12760-6
	SB2D	5 - 10	11/7/96	IM		X	X	X	X			D96-12760-7
	SB3	10 - 15	11/7/96	IM		X	X	X	X			D96-12760-8
	SB4	0 - 5	11/7/96	IM		X	X	X	X			D96-12760-9
	SB5	5 - 10	11/7/96	IM		X	X	X	X			D96-12760-10
	SB6	10 - 15	11/7/96	IM		X	X	X	X			D96-12760-11
24T02	SB1	0 - 5	11/8/96	IM		X	X	X	X			D96-12805-1
	SB2	5 - 10	11/8/96	IM		X	X	X	X			D96-12805-2
	SB3	10 - 15	11/8/96	IM		X	X	X	X			D96-12805-3
24T03	SB1	0 - 5	11/7/96	IM		X	X	X	X		Rinsate	D96-12760-2
	SB1R		11/7/96	IM		X	X	X	X			D96-12760-1
	SB2	5 - 10	11/7/96	IM		X	X	X	X			D96-12760-3
	SB3	10 - 15	11/7/96	IM		X	X	X	X			D96-12760-4
24T04	SB1	0 - 5	11/8/96	IM		X	X	X	X		Matrix Spike Matrix Spike Duplicate Rinsate	D96-12805-4
	SB2	5 - 10	11/8/96	IM		X	X	X	X			D96-12805-5
	SB3	10 - 15	11/8/96	IM		X	X	X	X			D96-12805-6
	SB3MS	10 - 15	11/8/96	IM		X	X		X			D96-12805-21
	SB3MSD	10 - 15	11/8/96	IM		X	X		X			D96-12805-22
	SB3R		11/8/96	IM		X	X	X	X			D96-12805-9



**Table 18-1**  
**SWMU 24 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis					Comments	Lab ID Number
Point	Designator					VOC	PAH	TPH	RCRA Metals	pH		
24T05	SB1	0 - 5	11/8/96	IM		X	X	X	X			D96-12805-10
	SB2	5 - 10	11/8/96	IM		X	X	X	X			D96-12805-11
	SB3	10 - 15	11/8/96	IM		X	X	X	X			D96-12805-12
24T06	SB1	0 - 5	11/8/96	IM		X	X	X	X			D96-12805-13
	SB2	5 - 10	11/8/96	IM		X	X	X	X			D96-12805-14
	SB2D	5 - 10	11/8/96	IM		X	X	X	X		Field Duplicate	D96-12805-15
	SB3	10 - 15	11/8/96	IM		X	X	X	X			D96-12805-16
	SB3MS	10 - 15	11/8/96	IM		X	X		X		Matrix Spike	D96-12805-23
	SB3MSD	10 - 15	11/8/96	IM		X	X		X		Matrix Spike Duplicate	D96-12805-24
<b>PHASE 2 TRENCH SOIL SAMPLES</b>												
24T07	SB1	10 - 15	5/20/98	2	X		X		X	X		D98-3835-1
	SB2	15 - 20	5/20/98	2	X		X		X	X		D98-3835-2
	SB11	10 - 15	5/20/98	2	X		X		X	X		D98-3835-3
	SB12	15 - 20	5/20/98	2	X		X		X	X		D98-3835-4
24T08	SB1	0 - 2	5/20/98	2	X		X		X	X		D98-3835-5
	SB1D	0 - 2	5/20/98	2	X		X		X	X	Field Duplicate	D98-3835-6
	SB2	2 - 4	5/20/98	2	X		X		X	X		D98-3835-7
	SB11	0 - 2	5/20/98	2	X		X		X	X		D98-3835-8
	SB12	2 - 4	5/20/98	2	X		X		X	X		D98-3835-9
<b>INTERIM MEASURES TRENCH GROUNDWATER SAMPLES</b>												
24T06	GW1	NA	11/8/96	IM		X	X	X	X			D96-12805-18
<b>DIRECT-PUSH GROUNDWATER SAMPLES</b>												
06B06A	DW1	30 - 32	5/22/98	2		X						D98-3877-5
06B07A	DW1	30 - 32	5/22/98	2		X						D98-3877-6
06B10A	DW1	30 - 32	5/22/98	2		X						D98-3877-2
	DW1MS	30 - 32	5/22/98	2		X						D98-3877-3
	DW1MSD	30 - 32	5/22/98	2		X						D98-3877-4
06B11A	DW1	35 - 37	5/22/98	2		X						D98-3742-2
24B04	DW1	2.5 - 5.5	9/10/97	1		X	X	X	X	X	Hit groundwater with elevated PID	D97-11023-11
24B07	DW1	24 - 26	5/18/98	2		X						D98-3742-1
24B08	DW1	40 - 42	5/26/98	2		X						D98-3898-2
	DW1D	40 - 42	5/26/98	2		X					Field Duplicate	D98-3898-3
24B09	DW1	37 - 39	5/22/98	2		X						D98-3877-7
24B10	DW1	30 - 32	5/26/98	2		X						D98-3898-1

**Notes:**

ft = feet

IM = Interim Measures

PAH = Polyaromatic Hydrocarbons

PID = photoionization detector

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

XRF = X-Ray Fluorescence Spectroscopy

**Table 18-2**  
**SWMU 24 Interim Measures Composite Grid Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24G01/SR1 10/30/1996 0 0.5 D96-12383-1	24G01/SR2 10/30/1996 0.5 1 D96-12383-2	24G01/SR2D 10/30/1996 0.5 1 D96-12383-3 Duplicate	24G02/SR1 10/30/1996 0 0.5 D96-12383-4	24G02/SR2 10/30/1996 0.5 1 D96-12383-7	24G03/SR1 10/30/1996 0 0.5 D96-12383-8
<b>Volatiles</b>	UNITS	ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	UNITS						
Acenaphthene	mg/Kg	4.07 U	4.15 U	2.16 J	4.06 U	4 U	14.5 U
Anthracene	mg/Kg	4.07 U	1.46 J	3.94 J	4.06 U	4 U	14.5 U
Benzo(a)anthracene	mg/Kg	4.07 U	3.44 J	7.13 J	4.06 U	4 U	14.5 U
Benzo(a)pyrene	mg/Kg	4.07 U	4.15 U	6.62 J	4.06 U	4 U	14.5 U
Benzo(b)fluoranthene	mg/Kg	4.07 U	4.15 U	11.4 J	4.06 U	4 U	14.5 U
Chrysene	mg/Kg	4.07 U	2.99 J	8.11 J	4.06 U	4 U	14.5 U
Fluoranthene	mg/Kg	4.07 U	5.04 J	14.4 J	4.06 U	4 U	14.5 U
Fluorene	mg/Kg	4.07 U	4.15 U	1.89 J	4.06 U	4 U	14.5 U
Indeno(1,2,3-cd)pyrene	mg/Kg	4.07 U	4.15 U	2.93 J	4.06 U	4 U	14.5 U
Phenanthrene	mg/Kg	4.07 U	7.74 J	20.6 J	4.06 U	4 U	14.5 U
Pyrene	mg/Kg	4.07 U	7.4 J	20.1 J	4.06 U	4 U	14.5 U
<b>Total Detected SVOCs</b>	UNITS						
<b>Total Semi-Volatiles</b>	mg/Kg	ND	28.07	99.28	ND	ND	ND
<b>Metals, Total</b>	UNITS						
Barium, Total	mg/Kg	437	159	188	277	153	260
Cadmium, Total	mg/Kg	13.6 J*	13.7 J*	15 J*	16 J*	11 J*	16.3 J*
Chromium, Total	mg/Kg	232 J*	84 J*	134 J*	138 J*	90.2 J*	115 J*
Lead, Total	mg/Kg	1,140 J*	464 J*	409 J*	416 J*	295 J*	365 J*
Mercury, Total	mg/Kg	0.202	0.151 U	0.19	0.149	0.161	0.176 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-2**  
**SWMU 24 Interim Measures Composite Grid Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24G03/SR2 10/30/1996 0.5 1 D96-12383-10	24G04/SR1 10/30/1996 0 0.5 D96-12383-11	24G04/SR2 10/30/1996 0.5 1 D96-12383-12
<b>Volatiles</b>	<b>UNITS</b>			
		ND	ND	ND
<b>Semivolatiles</b>	<b>UNITS</b>			
Acenaphthene	mg/Kg	1.43 U	1.54 U	1.44 U
Anthracene	mg/Kg	1.43 U	1.54 U	1.44 U
Benzo(a)anthracene	mg/Kg	1.43 U	1.54 U	1.44 U
Benzo(a)pyrene	mg/Kg	1.43 U	1.54 U	1.44 U
Benzo(b)fluoranthene	mg/Kg	1.13 J	1.54 U	1.44 U
Chrysene	mg/Kg	1.43 U	1.54 U	1.44 U
Fluoranthene	mg/Kg	1.43 U	1.54 U	1.44 U
Fluorene	mg/Kg	1.43 U	1.54 U	1.44 U
Indeno(1,2,3-cd)pyrene	mg/Kg	1.43 U	1.54 U	1.44 U
Phenanthrene	mg/Kg	1.43 U	1.54 U	1.44 U
Pyrene	mg/Kg	1.5 U	1.54 U	1.44 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>			
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>2.63</b>	<b>ND</b>	<b>ND</b>
<b>Metals, Total</b>	<b>UNITS</b>			
Barium, Total	mg/Kg	220	138	134
Cadmium, Total	mg/Kg	13.8 J*	19.7 J*	14.1 J*
Chromium, Total	mg/Kg	92.8 J*	183 J*	59.2 J*
Lead, Total	mg/Kg	376 J*	473 J*	311 J*
Mercury, Total	mg/Kg	0.173 U	0.187 U	0.174 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-3**  
**SWMU 24 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24B01/DP1 9/10/1997 0 4 D97-11023-1	24B01/DP2 9/10/1997 6 10 D97-11023-2	24B02/DP1 9/10/1997 0 4 D97-11023-4	24B02/DP2 9/10/1997 4 8 D97-11023-5	24B02/DP2D 9/10/1997 4 8 D97-11023-6 Duplicate	24B03/DP1 9/10/1997 0 4 D97-11023-7	24B03/DP2 9/10/1997 4 8 D97-11023-10
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.35 U	0.429 U
Anthracene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.35 U	0.429 U
Benzo(a)anthracene	mg/Kg	0.196 J	0.419 U	0.395 U	0.447 U	0.426 U	0.533	0.429 U
Benzo(a)pyrene	mg/Kg	0.195 J	0.419 U	0.395 U	0.447 U	0.426 U	0.36	0.429 U
Benzo(b)fluoranthene	mg/Kg	0.298 J	0.419 U	0.234 J	0.447 U	0.426 U	0.643	0.429 U
Benzo(g,h,i)perylene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.25 J	0.429 U
Benzo(k)fluoranthene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.272 J	0.429 U
Chrysene	mg/Kg	0.208 J	0.419 U	0.395 U	0.447 U	0.426 U	0.469	0.429 U
Dibenzo(a,h)anthracene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.35 U	0.429 U
Fluoranthene	mg/Kg	0.365 J	0.419 U	0.21 J	0.447 U	0.426 U	0.837	0.429 U
Fluorene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.35 U	0.429 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.246 J	0.429 U
Naphthalene	mg/Kg	0.388 U	0.419 U	0.395 U	0.447 U	0.426 U	0.35 U	0.429 U
Phenanthrene	mg/Kg	0.404	0.214 J	0.395 U	0.447 U	0.426 U	0.805	0.429 U
Pyrene	mg/Kg	0.36 J	0.419 U	0.257 J	0.447 U	0.426 U	0.93	0.429 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>2.026</b>	<b>0.214</b>	<b>0.701</b>	<b>ND</b>	<b>ND</b>	<b>5.345</b>	<b>ND</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Arsenic, Total	mg/Kg	18.2	4.96	8.26	8.14	11.6	10.7	5.58
Barium, Total	mg/Kg	153	176	120	232	200	146	195
Cadmium, Total	mg/Kg	6.5	0.88	3.16	0.55 J	0.44 J	2.58	0.65
Chromium, Total	mg/Kg	73.1	17.1	51.8	19.5	17.7	22.4	15.3
Lead, Total	mg/Kg	223 F	18.3 F	69.4 F	16 F	14.7 F	129 F	15.6 F
Mercury, Total	mg/Kg	0.105 J	0.155 U	0.0642 J	0.166 U	0.045 J	0.297	0.0464 J
Selenium, Total	mg/Kg	0.9 J	1.29 U	5.23	1.38 U	1.31 U	0.92 J	1.3 U
Silver, Total	mg/Kg	0.53 J	0.64 U	0.61 U	0.69 U	0.65 U	0.53 U	0.65 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	8.3	8	8.2	8.2	8.1	7.8	8

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-3**  
**SWMU 24 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24B04/DP1 9/10/1997 0 4 D97-11023-12	24B04/DP1 9/10/1997 0 4 D97-11023-12R2	24B04/DP2 9/10/1997 4 8 D97-11023-13	24B05/DP1 9/10/1997 0 4 D97-11023-14	24B05/DP1 9/10/1997 0 4 D97-11023-14R2	24B05/DP2 9/10/1997 4 8 D97-11023-15	24B06/DP1 9/10/1997 0 4 D97-11023-16
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.365 J	3.76 DU	0.425 U	0.375 U
Anthracene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.675	3.76 DU	0.425 U	0.375 U
Benzo(a)anthracene	mg/Kg	0.565 J	8.05 DU	0.443 U	2.02	2.02 DJ	0.425 U	0.375 U
Benzo(a)pyrene	mg/Kg	0.541 J	8.05 DU	0.443 U	1.57	3.76 DU	0.425 U	0.375 U
Benzo(b)fluoranthene	mg/Kg	0.735 J	8.05 DU	0.443 U	2.21	1.95 DJ	0.425 U	0.201 J
Benzo(g,h,i)perylene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.683	3.76 DU	0.425 U	0.375 U
Benzo(k)fluoranthene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.807	3.76 DU	0.425 U	0.375 U
Chrysene	mg/Kg	0.58 J	8.05 DU	0.443 U	1.78	1.91 DJ	0.425 U	0.375 U
Dibenzo(a,h)anthracene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.276 J	3.76 DU	0.425 U	0.375 U
Fluoranthene	mg/Kg	0.761 J	8.05 DU	0.443 U	2.5	3.41 DJ	0.425 U	0.191 J
Fluorene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.35 J	3.76 DU	0.425 U	0.375 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.805 U	8.05 DU	0.443 U	0.675	3.76 DU	0.425 U	0.375 U
Naphthalene	mg/Kg	0.521 J	8.05 DU	0.443 U	0.293 J	3.76 DU	0.425 U	0.375 U
Phenanthrene	mg/Kg	1.33	8.05 DU	0.443 U	2.86	3.4 DJ	0.425 U	0.375 U
Pyrene	mg/Kg	1.56	8.05 DU	0.443 U	4.74	3.37 DJ	0.425 U	0.19 J
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>6.593</b>	<b>ND</b>	<b>ND</b>	<b>21.804</b>	<b>16.06</b>	<b>ND</b>	<b>0.582</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Arsenic, Total	mg/Kg	15.9	NA	5.56	56.4	NA	4.63	14.6
Barium, Total	mg/Kg	135	NA	197	155	NA	135	354
Cadmium, Total	mg/Kg	3.69	NA	0.8	3.32	NA	0.44 J	9.1
Chromium, Total	mg/Kg	92.2	NA	17.5	31.2	NA	15.5	269
Lead, Total	mg/Kg	256 F	NA	19.6 F	566 F	NA	12.2 F	330 F
Mercury, Total	mg/Kg	0.0999 J	NA	0.0613 J	0.357	NA	0.154 U	0.083 J
Selenium, Total	mg/Kg	1.22 U	NA	1.34 U	13.5	NA	1.29 U	5.8 DU
Silver, Total	mg/Kg	0.29 J	NA	0.67 U	1.56	NA	0.64 U	0.86
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	8.1	NA	7.9	7.5	NA	7.8	9.3

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-3**  
**SWMU 24 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24B06/DP2 9/10/1997 4 8 D97-11023-17	24B06/DP3 9/10/1997 8 12 D97-11023-18	24B06/DP4 9/10/1997 12 16 D97-11023-19
<b>Semivolatiles</b>	<b>UNITS</b>			
Acenaphthene	mg/Kg	0.383 U	0.384 U	0.407 U
Anthracene	mg/Kg	0.383 U	0.241 J	0.407 U
Benzo(a)anthracene	mg/Kg	0.383 U	0.6	0.407 U
Benzo(a)pyrene	mg/Kg	0.383 U	0.543	0.407 U
Benzo(b)fluoranthene	mg/Kg	0.383 U	0.78	0.407 U
Benzo(g,h,i)perylene	mg/Kg	0.383 U	0.263 J	0.407 U
Benzo(k)fluoranthene	mg/Kg	0.383 U	0.305 J	0.407 U
Chrysene	mg/Kg	0.383 U	0.592	0.407 U
Dibenzo(a,h)anthracene	mg/Kg	0.383 U	0.384 U	0.407 U
Fluoranthene	mg/Kg	0.225 J	0.996	0.407 U
Fluorene	mg/Kg	0.383 U	0.384 U	0.407 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.383 U	0.247 J	0.407 U
Naphthalene	mg/Kg	0.383 U	0.2 J	0.407 U
Phenanthrene	mg/Kg	0.383 U	0.852	0.407 U
Pyrene	mg/Kg	0.194 J	1.03	0.407 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>			
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>0.419</b>	<b>6.649</b>	<b>ND</b>
<b>Metals, Total</b>	<b>UNITS</b>			
Arsenic, Total	mg/Kg	7.89	21.1	4.6
Barium, Total	mg/Kg	245	174	172
Cadmium, Total	mg/Kg	4.32	10.9	0.56 J
Chromium, Total	mg/Kg	64.3	34.2	13.6
Lead, Total	mg/Kg	155 F	802 F	12.8 F
Mercury, Total	mg/Kg	0.0522 J	0.12 J	0.148 U
Selenium, Total	mg/Kg	1.16 U	1.42	1.23 U
Silver, Total	mg/Kg	0.58 U	0.87	0.62 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>			
pH	SU	9.2	7.8	7.8

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-4**  
**SWMU 24 Interim Measures Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24T01/SB1 11/7/1996 0 5 D96-12760-5	24T01/SB2 11/7/1996 5 10 D96-12760-6	24T01/SB2D 11/7/1996 5 10 D96-12760-7 Duplicate	24T01/SB3 11/7/1996 10 15 D96-12760-8	24T01/SB4 11/7/1996 0 5 D96-12760-9	24T01/SB5 11/7/1996 5 10 D96-12760-10
<b>Volatiles</b>	<b>UNITS</b>						
		ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	<b>UNITS</b>						
Anthracene	mg/Kg	4.14 U	0.394 U	0.379 U	0.408 U	0.365 U	0.391 U
Benzo(a)anthracene	mg/Kg	4.14 U	0.394 U	0.379 U	0.408 U	0.271 J	0.391 U
Benzo(a)pyrene	mg/Kg	4.14 U	0.394 U	0.379 U	0.408 U	0.376	0.391 U
Benzo(b)fluoranthene	mg/Kg	4.14 U	0.394 U	0.211 J	0.408 U	0.912	0.391 U
Benzo(g,h,i)perylene	mg/Kg	4.14 U	0.394 U	0.379 U	0.408 U	0.42	0.391 U
Benzo(k)fluoranthene	mg/Kg	4.14 U	0.394 U	0.221 J	0.408 U	0.482	0.391 U
Chrysene	mg/Kg	4.14 U	0.394 U	0.202 J	0.408 U	0.798	0.391 U
Fluoranthene	mg/Kg	4.14 U	0.191 J	0.355 J	0.408 U	0.597	0.391 U
Indeno(1,2,3-cd)pyrene	mg/Kg	4.14 U	0.394 U	0.379 U	0.408 U	0.359 J	0.391 U
Naphthalene	mg/Kg	4.14 U	0.394 U	0.198 J	0.408 U	0.365 U	0.391 U
Phenanthrene	mg/Kg	4.14 U	0.237 J	0.478	0.408 U	0.246 J	0.391 U
Pyrene	mg/Kg	4.14 U	0.169 J	0.315 J	0.408 U	0.698	0.391 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>						
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	ND	0.597	1.98	ND	5.159	ND
<b>Metals, Total</b>	<b>UNITS</b>						
Barium, Total	mg/Kg	506	331	245	137	546	167
Cadmium, Total	mg/Kg	40.4 F	31.1 F	22.8 F	6.5 F	49.5 F	5.83 F
Chromium, Total	mg/Kg	1,810 F	72.4 F	325 F	15.8 F	1,020 F	30.3 F
Lead, Total	mg/Kg	408 F	401 F	290 F	12.1 JF	1,480 F	33.9 F
Mercury, Total	mg/Kg	0.151 U	0.143 U	0.138 U	0.148 U	0.133 U	0.142 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-4**  
**SWMU 24 Interim Measures Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point:		24T01/SB6	24T02/SB1	24T02/SB2	24T02/SB3	24T03/SB1	24T03/SB2
Date Sampled:		11/7/1996	11/8/1996	11/8/1996	11/8/1996	11/7/1996	11/7/1996
Sample Depth From:		10	0	5	10	0	5
Sample Depth To:		15	5	10	15	5	10
Laboratory Number:		D96-12760-11	D96-12805-1	D96-12805-2	D96-12805-3	D96-12760-2	D96-12760-3
Sample Type:							
<b>Volatiles</b>	UNITS						
		ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	UNITS						
Anthracene	mg/Kg	0.43 U	0.354 U	0.31 J	0.406 U	0.389 U	0.382 U
Benzo(a)anthracene	mg/Kg	0.43 U	0.122 J	0.209 J	0.406 U	0.389 U	0.382 U
Benzo(a)pyrene	mg/Kg	0.43 U	0.121 J	0.191 J	0.406 U	0.389 U	0.382 U
Benzo(b)fluoranthene	mg/Kg	0.43 U	0.192 J	0.272 J	0.406 U	0.389 U	0.214 J
Benzo(g,h,i)perylene	mg/Kg	0.43 U	0.118 J	0.371 U	0.406 U	0.389 U	0.204 J
Benzo(k)fluoranthene	mg/Kg	0.43 U	0.354 U	0.371 U	0.406 U	0.389 U	0.382 U
Chrysene	mg/Kg	0.43 U	0.129 J	0.22 J	0.406 U	0.389 U	0.321 J
Fluoranthene	mg/Kg	0.43 U	0.354 U	0.412 J	0.406 U	0.389 U	0.283 J
Indeno(1,2,3-cd)pyrene	mg/Kg	0.43 U	0.354 U	0.371 U	0.406 U	0.389 U	0.382 U
Naphthalene	mg/Kg	0.43 U	0.354 U	0.371 U	0.406 U	0.389 U	0.382 U
Phenanthrene	mg/Kg	0.43 U	0.354 U	0.313 J	0.406 U	0.389 U	0.462 J
Pyrene	mg/Kg	0.43 U	0.354 U	0.299 J	0.406 U	0.389 U	0.399 J
<b>Total Detected SVOCs</b>	UNITS						
<b>Total Semi-Volatiles</b>	mg/Kg	ND	0.682	2.226	ND	ND	1.883
<b>Metals, Total</b>	UNITS						
Barium, Total	mg/Kg	179	294	128	177	733	552
Cadmium, Total	mg/Kg	6.33 F	32.1 FJ*	11 FJ*	5.75 FJ*	53.5 F	49.1 F
Chromium, Total	mg/Kg	27.7 F	3,890 F	97.6 F	15.5 F	1,340 F	1,070 F
Lead, Total	mg/Kg	27.6 F	15.8	158	11.6 J	1,280 F	959 F
Mercury, Total	mg/Kg	0.156 U	0.129 U	0.139	0.148 U	0.142 U	0.139 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 18-4**  
**SWMU 24 Interim Measures Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point:		24T03/SB3	24T04/SB1	24T04/SB2	24T04/SB3	24T05/SB1	24T05/SB2
Date Sampled:		11/7/1996	11/8/1996	11/8/1996	11/8/1996	11/8/1996	11/8/1996
Sample Depth From:		10	0	5	10	0	5
Sample Depth To:		15	5	10	15	5	10
Laboratory Number:		D96-12760-4	D96-12805-4	D96-12805-5	D96-12805-6	D96-12805-10	D96-12805-11
Sample Type:							
<b>Volatiles</b>	<b>UNITS</b>						
		ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	<b>UNITS</b>						
Anthracene	mg/Kg	0.387 U	0.328 J	0.419 U	0.418 U	0.362 U	1.38 U
Benzo(a)anthracene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Benzo(a)pyrene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Benzo(b)fluoranthene	mg/Kg	0.387 U	0.208 J	0.419 U	0.418 U	0.362 U	1.38 U
Benzo(g,h,i)perylene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Benzo(k)fluoranthene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Chrysene	mg/Kg	0.387 U	0.207 J	0.419 U	0.418 U	0.362 U	1.38 U
Fluoranthene	mg/Kg	0.387 U	0.262 J	0.419 U	0.418 U	0.362 U	1.38 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Naphthalene	mg/Kg	0.387 U	0.386 U	0.419 U	0.418 U	0.362 U	1.38 U
Phenanthrene	mg/Kg	0.387 U	0.331 J	0.419 U	0.418 U	0.362 U	1.38 U
Pyrene	mg/Kg	0.387 U	0.238 J	0.419 U	0.418 U	0.362 U	1.38 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>						
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	ND	1.574	ND	ND	ND	ND
<b>Metals, Total</b>	<b>UNITS</b>						
Barium, Total	mg/Kg	20.4	207	253	214	780	154
Cadmium, Total	mg/Kg	2.35 U	13.5 FJ*	8.58 FJ*	9.02 FJ*	55.1 FJ*	22.8 FJ*
Chromium, Total	mg/Kg	1.31 JF	80.2 F	22.1 F	14.1 F	959 F	41.9 F
Lead, Total	mg/Kg	11.7 U	11.7 U	42.4	30.8	1,730	362
Mercury, Total	mg/Kg	0.141 U	0.14 U	0.152 U	0.152 U	0.132 U	0.226

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-4**  
**SWMU 24 Interim Measures Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24T05/SB3 11/8/1996 10 15 D96-12805-12	24T06/SB1 11/8/1996 0 5 D96-12805-13	24T06/SB2 11/8/1996 5 10 D96-12805-14	24T06/SB2D 11/8/1996 5 10 D96-12805-15 Duplicate	24T06/SB3 11/8/1996 10 15 D96-12805-16
<b>Volatiles</b>	UNITS					
		ND	ND	ND	ND	ND
<b>Semivolatiles</b>	UNITS					
Anthracene	mg/Kg	1.23 U	1.31	0.406 U	0.415 U	0.417 U
Benzo(a)anthracene	mg/Kg	1.23 U	1.08 U	0.406 U	0.241 J	0.417 U
Benzo(a)pyrene	mg/Kg	1.23 U	1.08 U	0.406 U	0.222 J	0.417 U
Benzo(b)fluoranthene	mg/Kg	1.23 U	1.08 U	0.406 U	0.222 J	0.417 U
Benzo(g,h,i)perylene	mg/Kg	1.23 U	1.08 U	0.406 U	0.415 U	0.417 U
Benzo(k)fluoranthene	mg/Kg	1.23 U	1.08 U	0.406 U	0.415 U	0.417 U
Chrysene	mg/Kg	1.23 U	1.08 U	0.406 U	0.294 J	0.417 U
Fluoranthene	mg/Kg	1.23 U	1.08 U	0.406 U	0.407 J	0.417 U
Indeno(1,2,3-cd)pyrene	mg/Kg	1.23 U	1.08 U	0.406 U	0.415 U	0.417 U
Naphthalene	mg/Kg	1.23 U	1.08 U	0.406 U	0.415 U	0.417 U
Phenanthrene	mg/Kg	1.23 U	0.353 J	0.253 J	0.515	0.417 U
Pyrene	mg/Kg	0.665 J	0.551 J	0.229 J	0.622	0.417 U
<b>Total Detected SVOCs</b>	UNITS					
<b>Total Semi-Volatiles</b>	mg/Kg	0.665	2.214	0.482	2.523	ND
<b>Metals, Total</b>	UNITS					
Barium, Total	mg/Kg	201	402	245	203	154
Cadmium, Total	mg/Kg	17.3 FJ*	31.1 FJ*	20.4 FJ*	18.2 FJ*	6.42 F
Chromium, Total	mg/Kg	15.6 F	1,460 F	256 F	164 F	16.2 F
Lead, Total	mg/Kg	138	309	340	245	12 J
Mercury, Total	mg/Kg	0.264	0.152	0.148 U	0.151 U	0.152 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-5**  
**SWMU 24 Phase 2 Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24T07/SB1 5/20/1998 10 15 D98-3835-1	24T07/SB1 5/20/1998 10 15 D98-3836-1	24T07/SB2 5/20/1998 15 20 D98-3835-2	24T07/SB2 5/20/1998 15 20 D98-3836-2	24T07/SB11 5/20/1998 10 15 D98-3835-3	24T07/SB11 5/20/1998 10 15 D98-3836-3	24T07/SB12 5/20/1998 15 20 D98-3835-4
<b>Semivolatiles</b>	<b>UNITS</b>							
Benzo(b)fluoranthene	mg/Kg	NA	0.327 U	NA	0.33 U	NA	0.33 U	NA
Fluoranthene	mg/Kg	NA	0.327 U	NA	0.33 U	NA	0.33 U	NA
Naphthalene	mg/Kg	NA	0.327 U	NA	0.33 U	NA	0.33 U	NA
Phenanthrene	mg/Kg	NA	0.327 U	NA	0.33 U	NA	0.33 U	NA
Pyrene	mg/Kg	NA	0.327 U	NA	0.33 U	NA	0.33 U	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	NA	ND	NA	ND	NA	ND	NA
<b>Metals, Total</b>	<b>UNITS</b>							
Arsenic, Total	mg/Kg	4.04	NA	7.36	NA	4.8	NA	5.19
Barium, Total	mg/Kg	182 J*	NA	184 J*	NA	158 J*	NA	117 J*
Cadmium, Total	mg/Kg	0.44 J	NA	0.64 J	NA	0.72	NA	0.31 J
Chromium, Total	mg/Kg	17.4	NA	18.5	NA	18.2	NA	18.1
Lead, Total	mg/Kg	11.2	NA	11.7	NA	10.9	NA	12.6
Mercury, Total	mg/Kg	0.149 U	NA	0.157 U	NA	0.147 U	NA	0.147 U
Selenium, Total	mg/Kg	1.24 UJ*	NA	1.3 UJ*	NA	1.23 UJ*	NA	1.23 UJ*
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	NA	8.7	NA	8.9	NA	8.1	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-5**  
**SWMU 24 Phase 2 Trenching Soil Results**  
**Armco Kansas City Facility**

Sample Point:		24T07/SB12	24T08/SB1	24T08/SB1D	24T08/SB2	24T08/SB11	24T08/SB12
Date Sampled:		5/20/1998	5/20/1998	5/20/1998	5/20/1998	5/20/1998	5/20/1998
Sample Depth From:		15	0	0	2	0	2
Sample Depth To:		20	2	2	4	2	4
Laboratory Number:		D98-3836-4	D98-3835-5	D98-3835-6	D98-3835-7	D98-3835-8	D98-3835-9
Sample Type:				Duplicate			
<b>Semivolatiles</b>	<b>UNITS</b>						
Benzo(b)fluoranthene	mg/Kg	0.33 U	1.15 UJ*	0.381 UJ*	0.401 UJ*	0.402 UJ*	0.149 J
Fluoranthene	mg/Kg	0.33 U	1.15 UJ*	0.381 UJ*	0.401 UJ*	0.402 UJ*	0.216 J
Naphthalene	mg/Kg	0.33 U	1.15 UJ*	0.381 UJ*	0.401 UJ*	0.402 UJ*	0.251 J
Phenanthrene	mg/Kg	0.33 U	1.15 UJ*	0.381 UJ*	0.401 UJ*	0.402 UJ*	0.337 J
Pyrene	mg/Kg	0.33 U	1.15 UJ*	0.381 UJ*	0.401 UJ*	0.402 UJ*	0.143 J
<b>Total Detected SVOCs</b>	<b>UNITS</b>						
Total Semi-Volatiles	mg/Kg	ND	ND	ND	ND	ND	1.096
<b>Metals, Total</b>	<b>UNITS</b>						
Arsenic, Total	mg/Kg	NA	27.3	23.5	15.4	8.3	12.5
Barium, Total	mg/Kg	NA	78.8 J*	97.5 J*	118 J*	211 J*	166 J*
Cadmium, Total	mg/Kg	NA	0.85	0.82	0.67	0.56 J	1.44
Chromium, Total	mg/Kg	NA	34.7	35.8	33.1	25.1	25.9
Lead, Total	mg/Kg	NA	27.9	21.9	15.3	13.9	28.9
Mercury, Total	mg/Kg	NA	0.14 U	0.138 U	0.146 U	0.146 U	0.0624 J
Selenium, Total	mg/Kg	NA	1.17 UJ*	1.15 UJ*	1.22 UJ*	1.22 UJ*	1.31 J*
<b>Physical Properties of Soil</b>	<b>UNITS</b>						
pH	SU	8.1	8.5 J*	8.5 J*	8.3 J*	8 J*	8.3 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J\* - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-6**  
**SWMU 24 Interim Measures Trench Sample Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		24T06/GW1 11/8/1996 D96-12805-18
<b>Volatiles</b>	<b>UNITS</b>	
		ND
<b>Semivolatiles</b>	<b>UNITS</b>	
		ND
<b>Metals, Total</b>	<b>UNITS</b>	
Barium, Total	mg/L	0.395
Cadmium, Total	mg/L	0.0333 FJ*
Chromium, Total	mg/L	0.0864 F
Lead, Total	mg/L	0.768
Mercury, Total	mg/L	0.0004

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
ND - Not Detected

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-7**  
**SWMU 24 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		24B04/DW1 9/10/1997 2.5 5.5 D97-11023-11	24B07/DW1 5/18/1998 24 26 D98-3742-1	24B07/DW1 5/18/1998 24 26 D98-3742-1R2	24B08/DW1 5/26/1998 40 42 D98-3898-2	24B08/DW1D 5/26/1998 40 42 D98-3898-3 Duplicate	24B09/DW1 5/22/1998 37 39 D98-3877-7	24B10/DW1 5/26/1998 30 32 D98-3898-1			
Volatiles		UNITS		Reanalysis							
1,1,1-Trichloroethane	ug/L	5	U	3.28	J	5	U	10	DU	5	U
1,1,2-Trichloroethane	ug/L	5	U	2.58	J	5	U	10	DU	5	U
1,1-Dichloroethane	ug/L	12		4.9	J	5	U	10	DU	5	U
1,2-Dichloroethane	ug/L	5	U	4.35	J	5	U	10	DU	5	U
1,2-Dichloropropane	ug/L	5	U	2.74	J	5	U	10	DU	5	U
4-Methyl-2-pentanone	ug/L	18.2	J	100	UJ*	100	U	11.1	DJ	4.82	J
Acetone	ug/L	138		100	UJ*	100	U	36.5	DJ	24.4	J
Benzene	ug/L	5	U	3.31	J	5	U	10	DU	5	U
Carbon disulfide	ug/L	5	U	3.46	J	5	U	10	DU	5	U
Carbon tetrachloride	ug/L	5	U	2.98	J	5	U	10	DU	5	U
Chloroform	ug/L	5	U	3.48	J	5	U	10	DU	5	U
cis-1,2-Dichloroethene	ug/L	295		5	UJ*	5	U	10	DU	5	U
Ethylbenzene	ug/L	5	U	5.62	J*	5	U	18	D	7.29	J*
m,p-Xylene	ug/L	5	U	10.3	J*	5	U	65	D	27.1	J*
Methylene chloride	ug/L	5	U	2.66	J	5	U	10	DU	5	U
o-Xylene	ug/L	5	U	4.35	J	5	U	15.4	D	5	U
Toluene	ug/L	5	U	4.95	J	5	U	41.9	D	16.6	J*
trans-1,2-Dichloroethene	ug/L	10.1		4.08	J	5	U	10	DU	5	U
Trichloroethene	ug/L	149		4.02	J	5	U	10	DU	5	U
Vinyl acetate	ug/L	54.6		50	UJ*	50	U	100	DU	50	U
Vinyl chloride	ug/L	5.34		2	UJ*	2	U	4	DU	2	U
Total Detected VOCs	UNITS										
Total Volatiles	ug/L	682.24		67.06		ND		187.9		80.21	
Semivolatiles	UNITS										
		ND		NA		NA		NA		NA	
Metals, Dissolved	UNITS										
Arsenic, Dissolved	mg/L	0.02		NA		NA		NA		NA	
Barium, Dissolved	mg/L	0.0699		NA		NA		NA		NA	
Water Quality Parameters	UNITS										
pH	SU	9.5		NA		NA		NA		NA	

LEGEND: B - Detected in the associated laboratory method blank F - Detected in the associated equipment rinsate blank J - Qualified as estimated by the laboratory  
R - Qualified as unusable in the QC evaluation T - Detected in associated trip blank U - Qualified as undetected by the laboratory  
NA - Not Analyzed ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 18-7**  
**SWMU 24 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		06B06A/DW1 5/22/1998 30 32 D98-3877-5	06B07A/DW1 5/22/1998 30 32 D98-3877-6	06B10A/DW1 5/22/1998 30 32 D98-3877-2	06B11A/DW1 5/18/1998 35 37 D98-3742-2	06B11A/DW1 5/18/1998 35 37 D98-3742-2R2
		Reanalysis				
Volatiles	UNITS					
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	26	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	ug/L	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	ug/L	100 U	100 U	100 U	100 U	100 U
Acetone	ug/L	100 U	100 U	100 U	100 U	100 U
Benzene	ug/L	5 U	5 U	5 U	5 U	5 U
Carbon disulfide	ug/L	5 U	5 U	5 U	2.77 J	5 U
Carbon tetrachloride	ug/L	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	ug/L	5 U	5 U	5 U	5 U	5 U
m,p-Xylene	ug/L	5 U	5 U	5 U	5 U	5 U
Methylene chloride	ug/L	5 U	5 U	5 U	5 U	5 U
o-Xylene	ug/L	5 U	5 U	5 U	5 U	5 U
Toluene	ug/L	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	5 U	5 U	5 U	2.62 J	5 U
Vinyl acetate	ug/L	50 U	50 U	50 U	50 U	50 U
Vinyl chloride	ug/L	2 U	2 U	2 U	2 U	2 U
Total Detected VOCs	UNITS					
Total Volatiles	ug/L	26	ND	ND	5.39	ND
Semivolatiles	UNITS					
		NA	NA	NA	NA	NA
Metals, Dissolved	UNITS					
Arsenic, Dissolved	mg/L	NA	NA	NA	NA	NA
Barium, Dissolved	mg/L	NA	NA	NA	NA	NA
Water Quality Parameters	UNITS					
pH	SU	NA	NA	NA	NA	NA

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 18-8**  
**SWMU 24 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Results
<b>Semivolatiles</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Benzo(a)anthracene	2	24G01 / SR2	0.5 - 1	3.44 J
		24G01 / SR2D	0.5 - 1	7.13
		24B05 / DP1	0 - 4	2.02
		24B05 / DP1**	0 - 4	2.02 DJ
Benzo(b)fluoranthene	5	24G01 / SR2D	0.5 - 1	11.4
<b>Metals</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Arsenic, Total	29	24B05 / DP1	0 - 4	56.4
Cadmium, Total	8	24G01 / SR1	0 - 0.5	13.6 J*
		24G01 / SR2	0.5 - 1	13.7 J*
		24G01 / SR2D	0.5 - 1	15 J*
		24G02 / SR1	0 - 0.5	16 J*
		24G02 / SR2	0.5 - 1	11 J*
		24G03 / SR1	0 - 0.5	16.3 J*
		24G03 / SR2	0.5 - 1	13.8 J*
		24G04 / SR1	0 - 0.5	19.7 J*
		24G04 / SR2	0.5 - 1	14.1 J*
		24B06 / DP1	0 - 4	9.1
		24B06 / DP3	8 - 12	10.9
		24T01 / SB1	0 - 5	40.4 F
		24T01 / SB2	5 - 10	31.1 F
		24T01 / SB2D	5 - 10	22.8 F
		24T01 / SB4	0 - 5	49.5 F
		24T02 / SB1	0 - 5	32.1 FJ*
		24T02 / SB2	5 - 10	11 FJ*
		24T03 / SB1	0 - 5	53.5 F
		24T03 / SB2	5 - 10	49.1 F
		24T04 / SB1	0 - 5	13.5 FJ*
		24T04 / SB2	5 - 10	8.58 FJ*
		24T04 / SB3	10 - 15	9.02 FJ*
		24T05 / SB1	0 - 5	55.1 FJ*
		24T05 / SB2	5 - 10	22.8 FJ*
		24T05 / SB3	10 - 15	17.03 FJ*
		24T06 / SB1	0 - 5	31.1 FJ*
		24T06 / SB2	5 - 10	20.4 FJ*
		24T06 / SB2D	5 - 10	18.2 FJ*
Chromium, Total	3540***	24T02 / SB1	0 - 5	3890 F
Lead, Total	400	24G01 / SR1	0 - 0.5	1140 J*
		24G01 / SR2	0.5 - 1	464 J*
		24G01 / SR2D	0.5 - 1	409 J*
		24G02 / SR1	0 - 0.5	416 J*
		24G04 / SR1	0 - 0.5	473 J*
		24B05 / DP1	0 - 4	566 F
		24B06 / DP3	8 - 12	802 F
		24T01 / SB1	0 - 5	408 F
		24T01 / SB2	5 - 10	401 F
		24T01 / SB4	0 - 5	1480 F
		24T03 / SB1	0 - 5	1280 F
		24T03 / SB2	5 - 10	959 F
		24T05 / SB1	0 - 5	1730

**Table 18-8**  
**SWMU 24 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Results
Selenium, Total	5	24B02 / DP1	0 - 4	5.23
		24B05 / DP1	0 - 4	13.5

**Notes:**

D = Sample was diluted prior to analysis

DAF = Dilution Attenuation Factor

F = Compound was detected in corresponding equipment rinsate blank.

ft = feet

J = Estimated value; concentration below practical quantitation limit.

J\* = Qualified as estimated by BMWCI during the QC evaluation.

SSL = Soil Screening Level

\*\* = Represents a reanalyzed sample.

\*\*\* = Screening value represents 95% UTL for chromium as calculated from slag samples.

**Table 18-9**  
**SWMU 24 Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

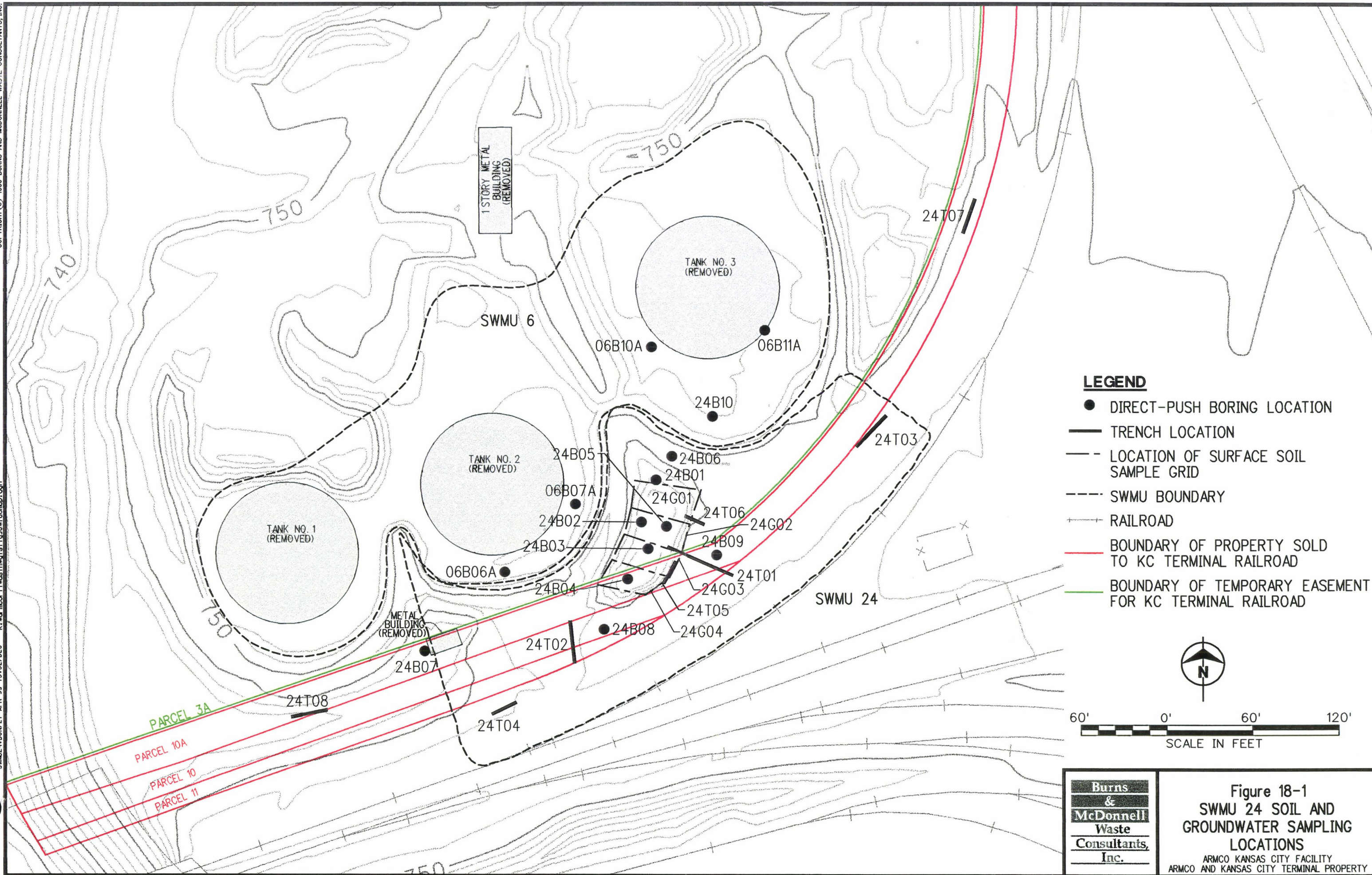
Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
<b>Volatiles</b>	(µg/L)			(µg/L)
cis-1,2-Dichloroethene	70	24B04 / DW1	2.5 - 5.5	295
Trichloroethene	5	24B04 / DW1	2.5 - 5.5	149
Vinyl Chloride	2	24B04 / DW1	2.5 - 5.5	5.34
<b>Metals</b>	(mg/L)			(mg/L)
Cadmium, Total	0.005	24T06 / GW1	NA	0.0333
Lead, Total	0.015	24T06 / GW1	NA	0.768

Notes:

ft = feet

MCL = Maximum Contaminant Level





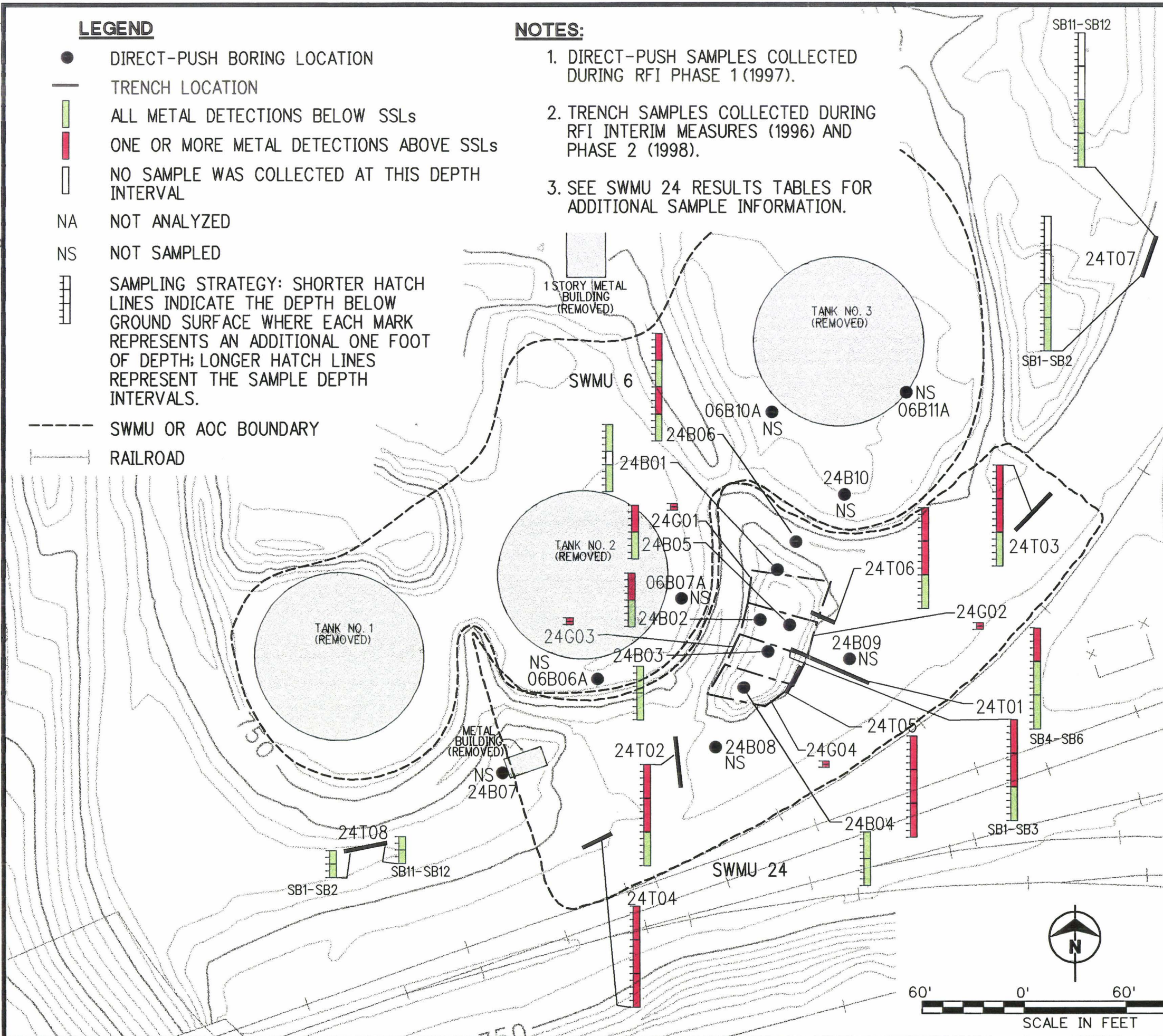


# LEGEND

- DIRECT-PUSH BORING LOCATION
- TRENCH LOCATION
- ALL METAL DETECTIONS BELOW SSLs
- ONE OR MORE METAL DETECTIONS ABOVE SSLs
- NO SAMPLE WAS COLLECTED AT THIS DEPTH INTERVAL
- NA NOT ANALYZED
- NS NOT SAMPLED
- SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.
- SWMU OR AOC BOUNDARY
- RAILROAD

## NOTES:

1. DIRECT-PUSH SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
2. TRENCH SAMPLES COLLECTED DURING RFI INTERIM MEASURES (1996) AND PHASE 2 (1998).
3. SEE SWMU 24 RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



METAL SOIL DETECTIONS ABOVE SSLs				
PARAMETER	SSL (mg/kg)	SAMPLE	SAMPLE DEPTH (FT BGS)	SAMPLE RESULT (mg/Kg)
ARSENIC	29	24B05/DP1	0-4	56.4
CADMIUM	8	24G01/SR1	0-0.5	13.6 J*
		24G01/SR2	0.5-1	13.7 J*
		24G01/SR2D	0.5-1	15 J*
		24G02/SR1	0-0.5	16 J*
		24G02/SR2	0.5-1	11 J*
		24G03/SR1	0-0.5	16.3 J*
		24G03/SR2	0.5-1	13.8 J*
		24G04/SR1	0-0.5	19.7 J*
		24G04/SR2	0.5-1	14.1 J*
		24B06/DP1	0-4	9.1
		24B06/DP3	8-12	10.9
		24T01/SB1	0-5	40.4 F
		24T01/SB2	5-10	31.1 F
		24T01/SB2D	5-10	22.8 F
		24T01/SB4	0-5	49.5 F
		24T02/SB1	0-5	32.1 FJ*
		24T02/SB2	5-10	11 FJ*
		24T03/SB1	0-5	53.5 F
		24T03/SB2	5-10	49.1 F
		24T04/SB1	0-5	13.5 FJ*
		24T04/SB2	5-10	8.58 FJ*
		24T04/SB3	10-15	9.02 FJ*
		24T05/SB1	0-5	55.1 FJ*
		24T05/SB2	5-10	22.8 FJ*
		24T05/SB3	10-15	17.03 FJ*
		24T06/SB1	0-5	31.1 FJ*
		24T06/SB2	5-10	20.4 FJ*
		24T06/SB2D	5-10	18.2 FJ*
CHROMIUM	3,540	24T02/SB1	0-5	3890 F
LEAD	400	24G01/SR1	0-0.5	1140 J*
		24G01/SR2	0.5-1	464 J*
		24G01/SR2D	0.5-1	409 J*
		24G02/SR1	0-0.5	416 J*
		24G04/SR1	0-0.5	473 J*
		24B05/DP1	0-4	566 F
		24B06/DP3	8-12	802 F
		24T01/SB1	0-5	408 F
		24T01/SB2	5-10	401 F
		24T01/SB4	0-5	1480 F
SELENIUM	5	24T03/SB1	0-5	1280 F
		24T03/SB2	5-10	959 F
		24T05/SB1	0-5	1730 F
SELENIUM	5	24B02/DP1	0-4	5.23
		24B05/DP1	0-4	13.5

QUALIFIER NOTES:  
D = SAMPLE DILUTED PRIOR TO ANALYSIS  
F = COMPOUND DETECTED IN CORRESPONDING RINSATE BLANK  
J = ESTIMATED VALUE  
J\* = QUALIFIED AS ESTIMATED DURING QC EVALUATION

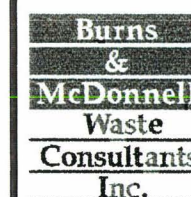


Figure 18-2  
SWMU 24 METALS  
SOIL RESULTS

ARMCO KANSAS CITY FACILITY  
ARMCO AND KANSAS CITY TERMINAL PROPERTY

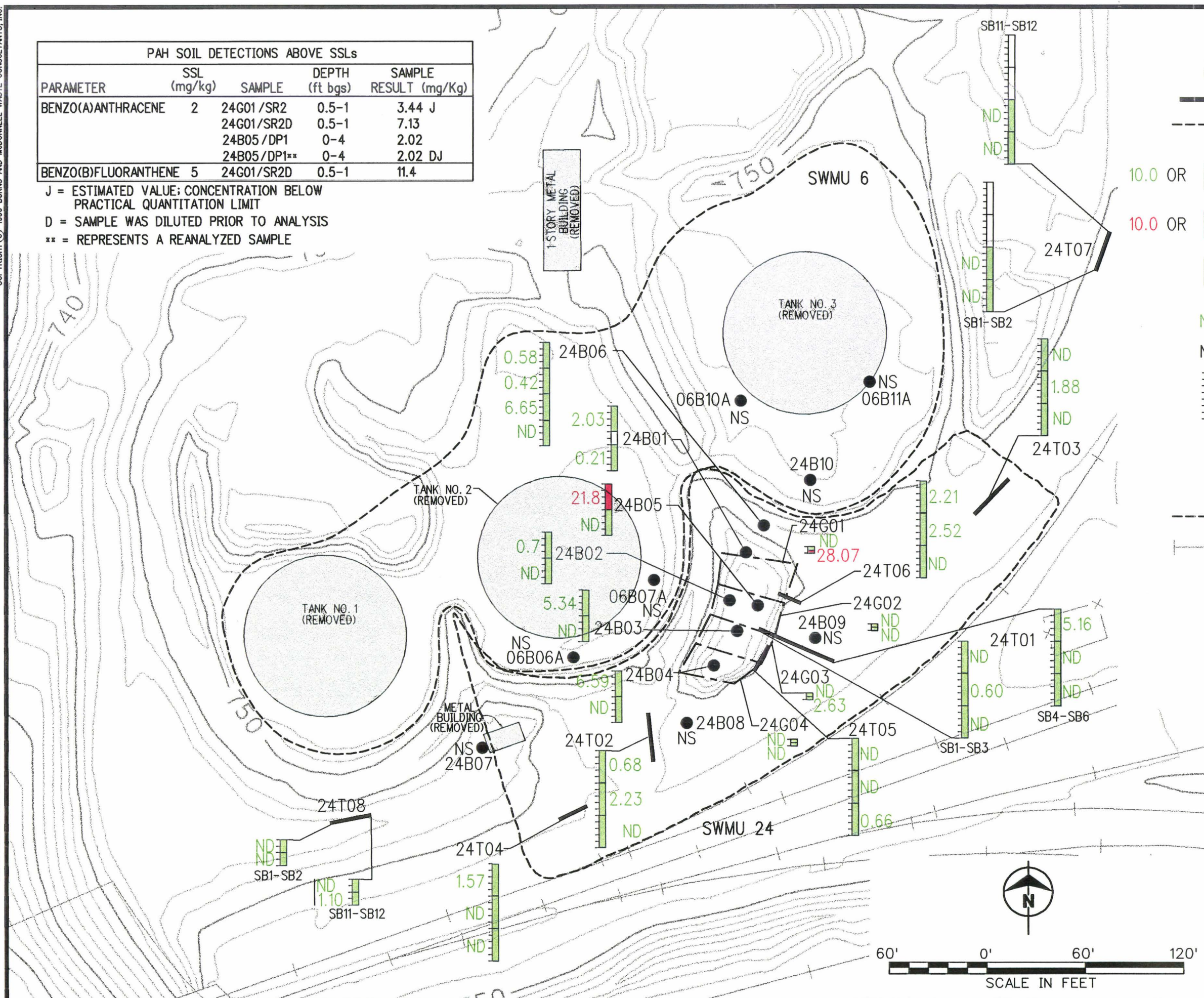




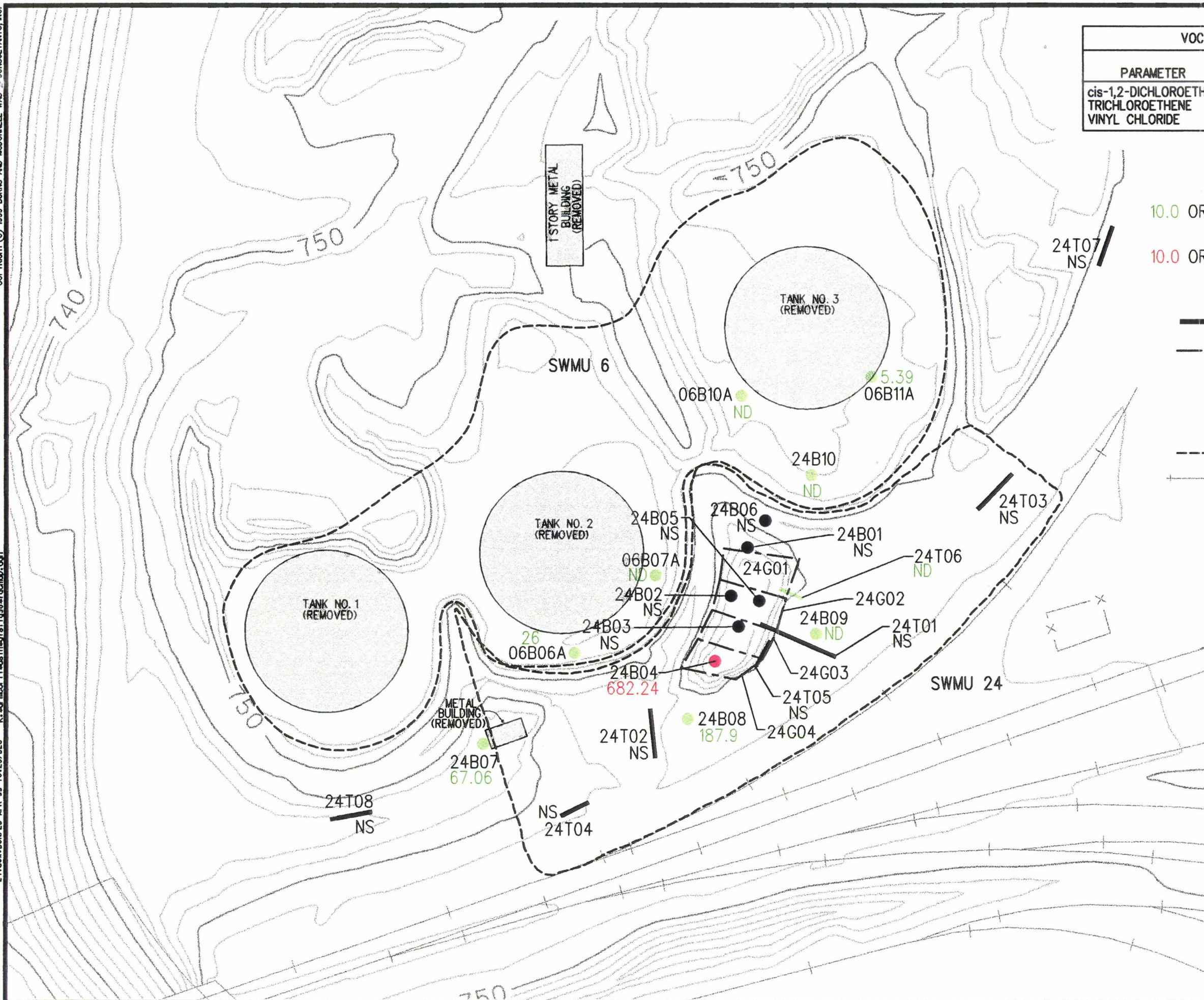


J = ESTIMATED VALUE; CONCENTRATION BELOW PRACTICAL QUANTITATION LIMIT  
D = SAMPLE WAS DILUTED PRIOR TO ANALYSIS  
\*\* = REPRESENTS A REANALYZED SAMPLE

ARMCO KANSAS CITY FACILITY  
ARMCO AND KANSAS CITY TERMINAL PROPERTY







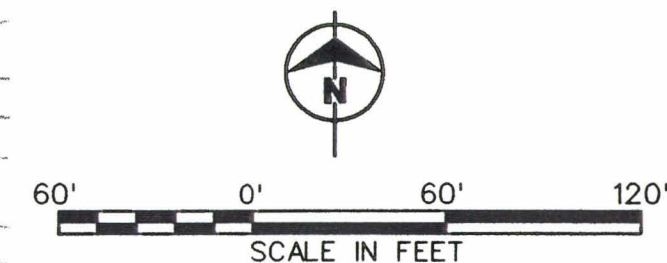
VOC GROUNDWATER DETECTIONS ABOVE MCLs				
PARAMETER	MCL (ug/L)	SAMPLE	SAMPLE DEPTH (FT)	SAMPLE RESULT (ug/L)
cis-1,2-DICHLOROETHENE	70	24B04/DW1	2.5-5.5	295
TRICHLOROETHENE	5	24B04/DW1	2.5-5.5	149
VINYL CHLORIDE	2	24B04/DW1	2.5-5.5	5.34

# LEGEND

- DIRECT-PUSH BORING LOCATION
- 10.0 OR ● TOTAL VOC RESULTS (ug/L) - ALL DETECTIONS BELOW MCLs
- 10.0 OR ● TOTAL VOC RESULTS (ug/L) - ONE OR MORE DETECTIONS ABOVE MCLs (SEE INSET TABLE)
- TRENCH LOCATION
- - - LOCATION OF SURFACE SOIL SAMPLE GRID
- ND NOT DETECTED
- NS NOT SAMPLED
- - - SWMU BOUNDARY
- RAILROAD

# NOTES:

- DIRECT-PUSH GROUNDWATER SAMPLES COLLECTED DURING RFI PHASES 1 AND 2 (1997-1998).
- TRENCH SAMPLES TAKEN DURING RFI INTERIM MEASURES (1996).
- SEE SWMU 24 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 18-5  
SWMU 24 TOTAL VOC  
GROUNDWATER RESULTS**

ARMCO KANSAS CITY FACILITY  
ARMCO AND KANSAS CITY TERMINAL PROPERTY



**SWMU 25**  
**ROLL SHOP DRUM STORAGE AREA**  
**(GST PROPERTY)**

## **19.0 SWMU 25 – ROLL SHOP DRUM STORAGE AREA**

### **19.1 SWMU BACKGROUND**

#### **19.1.1 Description of SWMU**

Use of the Roll Shop Drum Storage Area, located on GST property, (see Figure 1-2) began in the early to mid 1970s. The area was used for the storage of drums of waste oil (hydraulic and lubricating oil from Roll Shop activities), swarf (cuttings from carbide rolls, which have resale value), worn or broken carbide tooling, spent acids, and other scrap metal. Waste oil drums stored in the area were placed on pallets located on asphalt pavement. SWMU 25 was only a temporary storage location, and waste oil drums stored at SWMU 25 were later transported to the Waste Oil Storage Area (SWMU 24). Information regarding analysis of waste oil previously generated by Armco was provided in Appendix B of the RFI Workplan. Used phosphoric and hydrochloric acids were occasionally stored in the area in 500 gallon ASTs prior to being taken to the mill water recirculation system for use as pH control. The defined SWMU area was approximately 45 feet by 10 to 18 feet (less than 0.01 acres) in size.

Use of SWMU 25 for waste oil storage ended in 1993. GST now stores waste oil on spill containment pallets at other locations on GST property for off-site recycling/disposal. SWMU 25 is now used by GST for temporary storage of a few drums of swarf, worn or broken carbide tooling, and other scrap metal. GST provides for transportation of the swarf off-site to be sold as product. Since 1993, Armco has no longer had control over any of the operations at the SWMU.

Based on the types of materials stored at SWMU 25 prior to the property transfer to GST, the primary constituents of potential concern were petroleum hydrocarbons associated with waste oil, heavy metals (possibly present in waste hydraulic and lubricating oil), and spent acid.

During a May 1991 visual site inspection, USEPA noted that the ground surface surrounding SWMU 25 was visually stained. Based upon this observation, SWMU 25 was designated in the Permit as an IM SWMU. IM activities were completed as described in Section 19.2.

### **19.1.2 Release Potential**

The primary release potential for this SWMU was to the surrounding soils. Based on a review of Armco records, no documented spills are known to have occurred during Armco's operations at this location.

## **19.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of surface and subsurface soil samples. Table 19-1 presents a summary of the investigation activities completed at SWMU 25, and Figure 19-1 shows the soil sampling locations.

### **19.2.1 Interim Measures Activities**

Four surface soil samples (25G01 through 25G04) were collected from locations initially scoped as soil boring locations in the Revised IMP. These soil borings were not completed in their planned locations due to the presence of subsurface utilities. Surface soil samples were collected immediately below the asphalt pavement to a depth of one-foot bgs. Borings 25B01 through 25B04 were relocated to the north of their originally planned locations. In addition, four borings (25B05 through 25B08) were installed to the north of Borings 25B01 through 25B04. Two or three soil samples were collected from each boring, typically at depth intervals of 0 to 2, 2 to 4, and 4 to 8 feet bgs (or until drilling refusal was encountered). A total of 22 subsurface soil samples were collected. All surface and subsurface soil samples were analyzed for PAHs, TPH, RCRA metals, and pH.

### **19.2.2 RFI Activities**

During RFI Phase 1, an attempt was made to install seven additional direct-push soil borings (25B09 through 25B15) to further define the nature and extent of contamination in accordance with RFI Workplan Addendum No. 2. Borings were attempted; however, frequent direct-push refusal was encountered due to the slag fill throughout the area. Only Boring 25B10 was successfully installed and one soil sample was collected at a depth of 4 to 7.5 feet bgs. This sample was analyzed for PAHs, TPH, RCRA Metals, and pH. Based on the difficulty

encountered in the attempt to install direct-push borings, completion of the investigation activities at this SWMU was postponed so that alternative sample collection methods could be evaluated.

During RFI Phase 2, a heavy track-mounted direct-push rig was used to install soil borings. Six direct-push soil borings were installed (25B09, 25B10A, and 25B12 through 25B15). Boring 25B11 could not be installed due to the thickness of a concrete pad that exceeded the length of the concrete coring machine's bit extension at its proposed sampling location. One or two soil samples were collected from each boring at typical depth intervals of 0 to 4, 4 to 8, and/or 8 to 12 feet bgs (or until direct-push refusal was encountered). Ten samples were collected and analyzed for PAHs, RCRA metals, and pH.

SWMU 25 is underlain by pebble to gravel size slag that is very dense. The density of the slag fill is probably a result of emplacement while extremely hot and/or by compaction from frequent heavy truck traffic. The density of the slag caused frequent refusal of the direct-push boring equipment. One of the borings may have penetrated through the slag fill material into clay at approximately 11 feet bgs.

### **19.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Tables 19-2 through 19-4 present the analytical results for SWMU 25. Figure 19-2 summarizes the cadmium and lead analytical results for SWMU 25. Figure 19-3 summarizes the PAH results for SWMU 25. TPH results are presented in Appendix U.

#### **19.3.1 Metals and pH**

All of the samples exhibited slightly basic or basic pH values. The pH for the surface soil samples ranged from 8.2 to 10. The pH for the subsurface soil samples ranged from 10.1 to 12.7, and tended to increase slightly or stay the same with increasing sample depth.

All of the RCRA metals were detected in the samples collected at SWMU 25. However, none of the arsenic, barium, chromium, selenium, or silver detections exceeded their respective 20 DAF

SSLs. The highest concentrations for each of these metals were 27.3 D, 636, 1,860, 4.45 DJ, and 1.84 DJ mg/Kg, respectively. Since no 20 DAF SSL exceedences were noted for arsenic, barium, chromium, selenium, and silver, the horizontal and vertical extent of detections for these metals were well defined by the boring locations.

Exceedences of the 20 DAF SSLs occurred for mercury, lead, and cadmium and are shown on Table 19-5. Mercury was detected in nine of the 37 soil samples, and one of these detections slightly exceeded the 20 DAF SSL (2 mg/Kg) in one sample.

The sample collected from the 4 to 5 feet bgs interval at Boring 25B04 contained a mercury detection of 2.57 mg/Kg. The horizontal extent of mercury was defined by surrounding borings that all contained mercury concentrations less than 2 mg/Kg or not detected. Although the exceedence of mercury in Boring 25B04 was in the deepest sample collected (4 to 5.5 feet bgs), the vertical extent of mercury in this area was defined by nearby borings (25B01 and 25B09). These borings had soil samples collected at deeper sampling intervals (up to 12 feet bgs) with mercury concentrations below the 20 DAF SSL or not detected.

Cadmium was detected in all of the 37 surface and subsurface soil samples. The number of detections, number of 20 DAF SSL exceedences, and highest cadmium concentrations are summarized below by depth interval.

Cadmium Results for SWMU 25 by Depth							
Depth (ft)	Number of Samples	Number of Detections	Number of 20 DAF SSL Exceedences	Highest Detection mg/Kg	Location	Second Highest Detection mg/Kg	Location
0-1	4	4	4	34.9 F	25G02	31.9 F	25G01
0-2	8	8	8	46.2 F	25B05	40.5	25B08
0-4	4	4	1	8.51 D	25B15	7.93 D	25B14
2-4	8	8	8	57.9 F	25B01	53 F	25B05
4-6	4	4	2	49 F	25B04	45.1 F	25B07
4-8	8	8	6	36.9 F	25B02	33.9 F	25B08
8-12	1	1	0	5.18 D	25B09	--	--

Lead was detected in all of the 37 surface and subsurface soil samples. The number of detections, number of 20 DAF SSL exceedences, and highest lead concentrations are summarized below by depth interval.

Lead Results for SWMU 25 by Depth							
Depth (ft)	Number of Samples	Number of Detections	Number of 20 DAF SSL Exceedences	Highest Detection mg/Kg	Location	Second Highest Detection mg/Kg	Location
0-1	4	4	1	462 J*	25G03	387 J*	25G01
0-2	8	8	6	1200	25B05	911	25B02
0-4	4	4	2	485 D	25B14	432 D	25B15
2-4	8	8	6	1120	25B01	620	25B02
4-6	4	4	2	527	25B07	454	25B04
4-8	8	8	4	1160 D	25B10A	608 D	25B14
8-12	1	1	1	3040 D	25B09	--	--

Cadmium and lead concentrations were below their respective 20 DAF SSLs for approximately 20 and 40 percent, respectively, of the samples collected. Cadmium concentrations exceeded the 20 DAF SSL (8 mg/Kg) for 29 of the 37 samples. Lead exceeded the 20 DAF SSL (400 mg/Kg) for 22 of the 37 samples.

Figure 19-2 presents the metals results and highlights locations with cadmium and lead 20 DAF SSL exceedences. The SWMU 25 area was expanded in size, primarily to the north, during the investigation to approximately 75 feet by 65 feet (less than 0.1 acres) in order to define the nature and extent of contamination. Exceedences of lead and cadmium occurred throughout the area sampled. No exceedences were noted in the northwestern portion of the SWMU 25 area (Borings 25B12 and 25B13), therefore defining the horizontal extent in this portion of the sampling area. Cadmium and/or lead slightly exceeded 20 DAF SSLs in the northeastern and eastern sampling locations (Borings 25B14 and 25B15, respectively). The 20 DAF SSLs for cadmium and lead were exceeded in the southernmost sampling locations along the Roll Shop foundation; however the physical restrictions of the Roll Shop and the concrete pad prevented additional sampling to the west and south. With the exception of the western sampling locations (Borings 25B12 and 25B13), cadmium and/or lead exceeded the 20 DAF SSL in the deepest interval at each sampling location. For the majority of these borings, vertical sampling was

completed to a depth at which direct-push refusal was encountered thereby limiting the ability to collect deeper samples. Due to numerous utilities in this area and frequent direct-push refusal, further sampling for horizontal and vertical extent definition could not be implemented.

### **19.3.2 PAHs**

Figure 19-3 presents the PAH results. PAHs were detected throughout the SWMU 25 area. Of the 32 samples with PAH detections, only Boring 25B09 had samples with individual PAH detections that exceeded their respective 20 DAF SSLs. The soil sample collected from the 4 to 8 feet bgs interval at 25B09 contained a dibenzo(a,h)anthracene detection of 2.42 mg/Kg that slightly exceeded its 2 mg/Kg 20 DAF SSL. The soil sample collected from the 8 to 12 feet bgs interval at 25B09 contained benzo(a)anthracene and benzo(b)fluoranthene detections (9.81 J\* and 9.44 J\* mg/Kg, respectively) which exceeded their respective 20 DAF SSLs of 2 and 5 mg/Kg.

The horizontal extent of PAHs was determined by Borings 25B13, 25B04, 25B07, 25B08 to the northwest, south, east, and north, respectively, of Boring 25B09. To the immediate west of Boring 25B09, the extent of PAHs was defined by the physical restrictions of the concrete pad. The vertical extent of PAHs was adequately defined throughout the majority of the SWMU 25 area. However, a small area near Boring 25B09 contained PAH exceedences in the deepest interval sampled (8 to 12 feet bgs). Due to numerous utilities in this area and frequent direct-push refusal, further sampling for horizontal and vertical extent definition could not be implemented.

## **19.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 25, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers). The area in which SWMU 25 is located is paved with concrete and asphalt. Therefore, storm water runoff, surface water transport, and airborne dust transport are not considered pathways for constituent migration at SWMU 25.

The nature and extent of contamination at SWMU 25 was assessed through the collection of surface and subsurface soil samples. Lead, cadmium, and PAH soil concentrations exceeded the 20 DAF SSLs (based on soil migration to groundwater) from the surface to 12 feet bgs (approximate deepest elevation 736 feet above MSL). Lead and cadmium exceedences occurred throughout the SWMU 25 area; however, PAH exceedences were limited to one sampling location. Therefore, soil transfer to groundwater could occur. Based on the asphalt and concrete surface covers, the tendency for metals and PAHs to strongly adsorb to soil, and the basic soil pH conditions at SWMU 25 (8.2 to 12.7), constituent migration via soil transfer to groundwater and storm sewer transport are not expected to be significant at SWMU 10.

Groundwater was not encountered during subsurface soil sampling at SWMU 25 and groundwater samples were not collected. Based on groundwater information from SWMU 33 and AOC 1 (located southwest of SWMU 25), the saturated zone is typically encountered at approximate elevations ranging from 737 to 739 feet above MSL. Based on the tendency for metals and PAHs to strongly adsorb to soil rather than migrate with groundwater flow, the groundwater transport pathway is not expected to be significant for SWMU 25.

## **19.5 RISK EVALUATION**

A risk evaluation of the Facility was conducted (see Appendices X and Y). The following sections provide a summary of specific risk evaluation conducted at SWMU 25.

### **19.5.1 Human Health Evaluation**

SVOCs and metals were identified as COPCs in both surface and subsurface soil. HHRA and lead modeling were conducted for SWMU 25 to evaluate potential health risks to on-site worker populations including existing and/or possible future full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in soil at SWMU 25. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.



### **19.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 25. Therefore, an ecological risk evaluation was not conducted for SWMU 25.

## **19.6 SUMMARY**

SWMU 25, located in the western portion of the Facility, is a former waste oil drum storage area. The defined SWMU area was approximately 45 feet by 10 to 18 feet (less than 0.01 acres) in size. The SWMU 25 area was expanded in size, primarily to the north, during the investigation to approximately 75 feet by 65 feet (less than 0.1 acres) in order to define the nature and extent of contamination. Thirty-seven surface soil and subsurface soil samples were collected at SWMU 25. Figures 19-2 and 19-3 summarize the extent of RCRA metals and PAH detections, respectively, at SWMU 25.

Soil pH values ranged from neutral to basic (pH 8.2 to 12.7). Cadmium, lead, and mercury were the only RCRA metals that had detections above the 20 DAF SSLs. Cadmium and lead detections exceeded 20 DAF SSLs (8 and 400 mg/Kg, respectively) throughout the sampling area, and extended to 8 feet bgs. Cadmium and lead concentrations ranged up to 57.9 F and 3,040 D mg/Kg, respectively. One detection of mercury at 2.57 mg/Kg slightly exceeded its 20 DAF SSL of 2 mg/Kg. The horizontal extent of cadmium and lead was adequately defined to the northwest of SWMU 25 and less clearly defined in the north and east portions of the sampling area. Sampling to the south and west of the SWMU area was restricted by the foundation of the Roll Shop and its adjacent concrete pad. With the exception of the northwestern sampling locations (Borings 25B12 and 25B13), cadmium and/or lead exceeded the 20 DAF SSL in the deepest interval at each sampling location, and vertical extent was not clearly defined. Due to numerous utilities in this area and frequent direct-push refusal, further sampling for horizontal and vertical extent definition could not be implemented.

PAHs were detected in the majority of the soil samples. One detection each of benzo(a)anthracene (9.81 J\* mg/Kg), benzo(b)fluoranthene (9.44 J\* mg/Kg), and dibenzo(a,h)anthracene (2.42 mg/Kg) exceeded 20 DAF SSLs (2, 5, and 2 mg/Kg, respectively),

all in samples collected from Boring 25B09. The horizontal extent of these PAH detections was adequately defined by surrounding sampling locations. With the exception of a small area near Boring 25B09, the vertical extent of PAHs was adequately defined throughout the majority of the SWMU 25 area.

Potential migration pathways at SWMU 25 include soil transfer to groundwater, groundwater transport, and storm sewer transport. Subsurface soil detections of lead, cadmium, and PAHs exceeded 20 DAF SSLs (based on soil migration to groundwater). Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Based on the asphalt and concrete surface covers that prevent storm water infiltration, the tendency of metals and PAHs to strongly adsorb to soil rather than migrate vertically or with groundwater movement, and the slightly basic pH soil conditions at SWMU 25, soil transfer to groundwater, storm sewer transport, and groundwater transport are not expected to be significant.

A risk evaluation was conducted for SWMU 25. For the human health evaluation, PAHs and metals were identified as COPCs in surface and subsurface soil. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to potential on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil at SWMU 25 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 25.

\* \* \* \* \*

**Table 19-1**  
**SWMU 25 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis				Comments	Lab ID Number
Point	Designator				PAH	TPH	RCRA Metals	pH		
SURFACE SOIL SAMPLES										
25G01	SR1	0 - 1	11/6/96	IM	X	X	X	X	Matrix Spike Matrix Spike Duplicate	D96-12650-1
	SR1MS	0 - 1	11/6/96	IM	X		X			D96-12650-2
	SR1MSD	0 - 1	11/6/96	IM	X		X			D96-12650-3
25G02	SR1	0 - 1	11/6/96	IM	X	X	X	X	Field Duplicate	D96-12650-4
	SR1D	0 - 1	11/6/96	IM	X	X	X	X		D96-12650-5
25G03	SR1	0 - 1	11/6/96	IM	X	X	X	X		D96-12650-6
25G04	SR1	0 - 1	11/6/96	IM	X	X	X	X	Rinsate	D96-12650-7
	SR1R		11/6/96	IM	X	X	X	X		D96-12650-8
SOIL BORING SAMPLES										
25B01	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-1
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-2
	CS3	4 - 7	11/4/96	IM	X	X	X	X		D96-12547-3
25B02	CS1	0 - 2	11/4/96	IM	X	X	X	X	Field Duplicate Matrix Spike Matrix Spike Duplicate	D96-12547-4
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-5
	CS2D	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-6
	CS2MS	2 - 4	11/4/96	IM	X		X			D96-12547-7
	CS2MSD	2 - 4	11/4/96	IM	X		X			D96-12547-8
	CS3	4 - 7	11/4/96	IM	X	X	X	X		D96-12547-9
25B03	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-10
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-11
	CS3	4 - 7	11/4/96	IM	X	X	X	X		D96-12547-12
25B04	CS1	0 - 2	11/4/96	IM	X	X	X	X	Rinsate	D96-12547-13
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-14
	CS3	4 - 5	11/4/96	IM	X	X	X	X		D96-12547-15
	CS3R		11/4/96	IM	X	X	X	X		D96-12547-23
25B05	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-16
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-17
25B06	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-18
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-19
25B07	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-20
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-21
	CS3	4 - 5.5	11/4/96	IM	X	X	X	X		D96-12547-22
25B08	CS1	0 - 2	11/4/96	IM	X	X	X	X		D96-12547-24
	CS2	2 - 4	11/4/96	IM	X	X	X	X		D96-12547-25
	CS3	4 - 8	11/4/96	IM	X	X	X	X		D96-12547-26
DIRECT-PUSH SOIL SAMPLES <sup>1</sup>										
25B09	DP1	4 - 8	6/8/98	2	X		X	X		D98-4202-1
	DP2	8 - 12	6/8/98	2	X		X	X		D98-4202-2
25B10	DP1	4 - 7.5	9/10/97	1	X	X	X	X		D97-11023-20
25B10A	DP1	4 - 8	6/8/98	2	X		X	X	Field Duplicate	D98-4202-3
	DP1D	4 - 8	6/8/98	2	X		X	X		D98-4202-4
25B12	DP1	0 - 4	6/8/98	2	X		X	X		D98-4202-5
	DP2	4 - 6	6/8/98	2	X		X	X		D98-4202-6
25B13	DP1	0 - 4	6/8/98	2	X		X	X	Rinsate	D98-4202-7
	DP1R		6/8/98	2	X		X	X		D98-4202-14
	DP2	4 - 6	6/8/98	2	X		X	X		D98-4202-8

**Table 19-1**  
**SWMU 25 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis				Comments	Lab ID Number
Point	Designator				PAH	TPH	RCRA Metals	pH		
25B14	DP1	0 - 4	6/8/98	2	X		X	X		D98-4202-9
	DP1MS	0 - 4	6/8/98	2	X		X	X	Matrix Spike	D98-4202-10
	DP1MSD	0 - 4	6/8/98	2	X		X	X	Matrix Spike Duplicate	D98-4202-11
	DP2	4 - 8	6/8/98	2	X		X	X		D98-4202-12
25B15	DP1	0 - 4	6/8/98	2	X		X	X		D98-4202-13

**Notes:**

ft = feet

IM = Interim Measures

PAH = Polyaromatic Hydrocarbons

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

<sup>1</sup> = Boring 25B11 could not be installed due to the thickness of a concrete pad that exceeded the length of the concrete coring machine's bit extension at its planned location.

**Table 19-2**  
**SWMU 25 Interim Measures Discrete Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25G01/SR1 11/6/96 0 1 D96-12650-1	25G02/SR1 11/6/96 0 1 D96-12650-4	25G02/SR1D 11/6/96 0 1 D96-12650-5 Duplicate	25G03/SR1 11/6/96 0 1 D96-12650-6	25G04/SR1 11/6/96 0 1 D96-12650-7
<b>Semivolatiles</b>	<b>UNITS</b>					
Acenaphthene	mg/Kg	0.367 U	0.37 U	0.368 U	0.379 U	0.372 U
Acenaphthylene	mg/Kg	0.367 U	0.37 U	0.368 U	0.379 U	0.372 U
Anthracene	mg/Kg	0.367 U	0.37 U	0.368 U	0.379 U	0.372 U
Benzo(a)anthracene	mg/Kg	0.367 U	0.37 U	0.368 U	0.832	0.372 U
Benzo(a)pyrene	mg/Kg	0.367 U	0.37 U	0.368 U	0.522	0.372 U
Benzo(b)fluoranthene	mg/Kg	0.367 U	0.37 U	0.378	1.26	0.372 U
Benzo(g,h,i)perylene	mg/Kg	0.367 U	0.37 U	0.233 J	0.661	0.372 U
Benzo(k)fluoranthene	mg/Kg	0.367 U	0.37 U	0.267 J	0.803	0.372 U
Chrysene	mg/Kg	0.367 U	0.207 J	0.219 J	1.24	0.372 U
Dibenzo(a,h)anthracene	mg/Kg	0.367 U	0.37 U	0.368 U	0.34 J	0.372 U
Fluoranthene	mg/Kg	0.367 U	0.37 U	0.19 J	1.35	0.372 U
Fluorene	mg/Kg	0.367 U	0.37 U	0.368 U	0.379 U	0.372 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.367 U	0.37 U	0.188 J	0.544	0.372 U
Naphthalene	mg/Kg	0.367 U	0.37 U	0.368 U	0.379 U	0.372 U
Phenanthrene	mg/Kg	0.367 U	0.37 U	0.368 U	0.289 J	0.372 U
Pyrene	mg/Kg	0.367 U	0.252 J	0.29 J	2.26	0.372 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>					
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>ND</b>	<b>0.459</b>	<b>1.765</b>	<b>10.101</b>	<b>ND</b>
<b>Metals, Total</b>	<b>UNITS</b>					
Arsenic, Total	mg/Kg	11.1 U	11.2 U	11.2 U	11.5 U	11.3 U
Barium, Total	mg/Kg	308	225	282	338	154
Cadmium, Total	mg/Kg	31.9 F	34.9 F	28.2 F	27 F	27.8 F
Chromium, Total	mg/Kg	752 F	1,070 F	572 F	650 F	566 F
Lead, Total	mg/Kg	387 J*	289 J*	359 J*	462 J*	286 J*
Mercury, Total	mg/Kg	0.134 UJ*	0.134 UJ*	0.134 UJ*	0.138 UJ*	0.135 UJ*
Selenium, Total	mg/Kg	27.8 U	28 U	27.9 U	28.7 U	28.2 U
Silver, Total	mg/Kg	1.11 U	1.12 U	1.12 U	1.15 U	1.13 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>					
<b>pH</b>	<b>SU</b>	<b>8.8</b>	<b>8.5</b>	<b>8.5</b>	<b>10</b>	<b>8.2</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-3**  
**SWMU 25 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25B01/CS1 11/4/96 0 2 D96-12547-1	25B01/CS2 11/4/96 2 4 D96-12547-2	25B01/CS3 11/4/96 4 7 D96-12547-3	25B02/CS1 11/4/96 0 2 D96-12547-4	25B02/CS2 11/4/96 2 4 D96-12547-5	25B02/CS2D 11/4/96 2 4 D96-12547-6 Duplicate	25B02/CS3 11/4/96 4 7 D96-12547-9
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	0.376 U	0.382 U	0.375 U	0.372 U	0.372 U	0.37 U	0.413 U
Anthracene	mg/Kg	0.376 U	0.382 U	0.375 U	0.372 U	0.372 U	0.37 U	0.413 U
Benzo(a)anthracene	mg/Kg	0.19 J	0.382 U	0.375 U	0.265 J	0.603	0.52	0.452
Benzo(a)pyrene	mg/Kg	0.221 J	0.382 U	0.375 U	0.235 J	0.546	0.611	0.507
Benzo(b)fluoranthene	mg/Kg	0.269 J	0.204 J	0.375 U	0.359 J	0.874	0.503	0.409 J
Benzo(g,h,i)perylene	mg/Kg	0.376 U	0.382 U	0.375 U	0.178 J	0.317 J	0.415	0.339 J
Benzo(k)fluoranthene	mg/Kg	0.376 U	0.382 U	0.375 U	0.332 J	0.272 J	0.604	0.413 U
Chrysene	mg/Kg	0.342 J	0.382 U	0.375 U	0.361 J	0.845	0.759	0.616
Dibenzo(a,h)anthracene	mg/Kg	0.376 U	0.382 U	0.375 U	0.372 U	0.334 J	0.325 J	0.228 J
Fluoranthene	mg/Kg	0.242 J	0.382 U	0.375 U	0.36 J	1.05	0.783	0.413 U
Fluorene	mg/Kg	0.376 U	0.382 U	0.375 U	0.372 U	0.372 U	0.37 U	0.413 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.376 U	0.382 U	0.375 U	0.153 J	0.603	0.572	0.208 J
Naphthalene	mg/Kg	0.376 U	0.382 U	0.375 U	0.372 U	0.372 U	0.37 U	0.413 U
Phenanthrene	mg/Kg	0.283 J	0.382 U	0.375 U	0.271 J	0.34 J	0.756	0.228 J
Pyrene	mg/Kg	0.343 J	0.203 J	0.375 U	0.489	1.42	1.12	0.24 J
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>1.89</b>	<b>0.407</b>	<b>ND</b>	<b>3.003</b>	<b>7.204</b>	<b>6.968</b>	<b>3.227</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Barium, Total	mg/Kg	413	474	512	317	350	357	256
Cadmium, Total	mg/Kg	39.9 F	57.9 F	29.9 F	39.8 F	45.6 F	41.2 F	36.9 F
Chromium, Total	mg/Kg	840	999	1,860	669	620	690	183
Lead, Total	mg/Kg	474	1,120	60.6	911	620	656	222
Mercury, Total	mg/Kg	0.137 U	0.139 U	0.136 U	0.135 U	0.135 U	0.918	0.15 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	10.3	10.8	12	11.3	11.3	11.2	11

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-3**  
**SWMU 25 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25B03/CS1 11/4/96 0 2 D96-12547-10	25B03/CS2 11/4/96 2 4 D96-12547-11	25B03/CS3 11/4/96 4 7 D96-12547-12	25B04/CS1 11/4/96 0 2 D96-12547-13	25B04/CS2 11/4/96 2 4 D96-12547-14	25B04/CS3 11/4/96 4 5 D96-12547-15	25B05/CS1 11/4/96 0 2 D96-12547-16
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Anthracene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Benzo(a)anthracene	mg/Kg	3.67 U	0.314 J	0.254 J	0.378 U	0.374 U	0.377 U	0.371 U
Benzo(a)pyrene	mg/Kg	3.67 U	0.39	0.29 J	0.164 J	0.374 U	0.377 U	0.371 U
Benzo(b)fluoranthene	mg/Kg	3.67 U	0.416	0.299 J	0.213 J	0.374 U	0.377 U	0.204 J
Benzo(g,h,i)perylene	mg/Kg	3.67 U	0.291 J	0.419 U	0.18 J	0.374 U	0.377 U	0.371 U
Benzo(k)fluoranthene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Chrysene	mg/Kg	3.67 U	0.444	0.287 J	0.243 J	0.374 U	0.377 U	0.232 J
Dibenzo(a,h)anthracene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Fluoranthene	mg/Kg	3.67 U	0.556	0.539	0.228 J	0.374 U	0.207 J	0.211 J
Fluorene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Indeno(1,2,3-cd)pyrene	mg/Kg	3.67 U	0.218 J	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Naphthalene	mg/Kg	3.67 U	0.369 U	0.419 U	0.378 U	0.374 U	0.377 U	0.371 U
Phenanthrene	mg/Kg	3.67 U	0.398	0.499	0.211 J	0.374 U	0.377 U	0.229 J
Pyrene	mg/Kg	3.67 U	0.498	0.432	0.279 J	0.374 U	0.377 U	0.183 J
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>ND</b>	<b>3.525</b>	<b>2.6</b>	<b>1.518</b>	<b>ND</b>	<b>0.207</b>	<b>1.059</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Barium, Total	mg/Kg	209	365	212	377	418	414	416
Cadmium, Total	mg/Kg	21.7 F	35.4 F	23.6 F	30.7 F	33.4 F	49 F	46.2 F
Chromium, Total	mg/Kg	386	767	75	948	709	1,150	709
Lead, Total	mg/Kg	415	612	107	368	526	454	1,200
Mercury, Total	mg/Kg	0.134 U	0.134 U	0.152 U	0.137 U	0.136 U	2.57	0.135 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	10.4	10.7	11.5	10.8	11	11.4	11

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-3**  
**SWMU 25 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25B05/CS2 11/4/96 2 4 D96-12547-17	25B06/CS1 11/4/96 0 2 D96-12547-18	25B06/CS2 11/4/96 2 4 D96-12547-19	25B07/CS1 11/4/96 0 2 D96-12547-20	25B07/CS2 11/4/96 2 4 D96-12547-21	25B07/CS3 11/4/96 4 5.5 D96-12547-22	25B08/CS1 11/4/96 0 2 D96-12547-24
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	0.362 U	0.365 U	0.368 U	0.371 U	0.388 U	0.21 J	0.367 U
Anthracene	mg/Kg	0.362 U	0.365 U	0.368 U	0.371 U	0.388 U	0.399	0.367 U
Benzo(a)anthracene	mg/Kg	0.362 U	0.365 U	0.532	0.371 U	0.186 J	1.37	0.367 U
Benzo(a)pyrene	mg/Kg	0.362 U	0.365 U	0.622	0.371 U	0.183 J	1.73	0.367 U
Benzo(b)fluoranthene	mg/Kg	0.225 J	0.365 U	0.542	0.371 U	0.289 J	2.19	0.233 J
Benzo(g,h,i)perylene	mg/Kg	0.362 U	0.365 U	0.771	0.272 J	0.165 J	0.97	0.158 J
Benzo(k)fluoranthene	mg/Kg	0.362 U	0.365 U	0.772	0.371 U	0.388 U	0.725	0.367 U
Chrysene	mg/Kg	0.237 J	0.365 U	0.768	0.216 J	0.415	1.63	0.246 J
Dibenzo(a,h)anthracene	mg/Kg	0.362 U	0.365 U	0.467	0.371 U	0.388 U	0.457	0.367 U
Fluoranthene	mg/Kg	0.297 J	0.365 U	0.518	0.133 J	0.172 J	2.21	0.198 J
Fluorene	mg/Kg	0.362 U	0.365 U	0.368 U	0.371 U	0.388 U	0.221 J	0.367 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.362 U	0.365 U	0.381	0.371 U	0.388 U	0.735	0.367 U
Naphthalene	mg/Kg	0.362 U	0.365 U	0.266 J	0.371 U	0.388 U	0.724	0.367 U
Phenanthrene	mg/Kg	0.198 J	0.128 J	0.46	0.179 J	0.389	1.76	0.367 U
Pyrene	mg/Kg	0.185 J	0.231 J	1.53	0.403	0.322 J	2.94	0.237 J
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>1.142</b>	<b>0.359</b>	<b>7.629</b>	<b>1.203</b>	<b>2.121</b>	<b>18.271</b>	<b>1.072</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Barium, Total	mg/Kg	312	291	375	368	636	227	381
Cadmium, Total	mg/Kg	53 F	22.3 F	28.2 F	27.4 F	28.2 F	45.1 F	40.5 F
Chromium, Total	mg/Kg	923	498	579	580	968	369	496
Lead, Total	mg/Kg	593	352	532	487	385	527	722
Mercury, Total	mg/Kg	0.132 U	0.133 U	0.134 U	0.135 U	0.141 U	0.785	0.134 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	11.1	10.2	10.1	10.2	10.8	10.6	11

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 19-3**  
**SWMU 25 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point:		25B08/CS2	25B08/CS3
Date Sampled:		11/4/96	11/4/96
Sample Depth From:		2	4
Sample Depth To:		4	8
Laboratory Number:		D96-12547-25	D96-12547-26
Sample Type:			
<b>Semivolatiles</b>	<b>UNITS</b>		
Acenaphthene	mg/Kg	0.395 U	0.404 U
Anthracene	mg/Kg	0.395 U	0.404 U
Benzo(a)anthracene	mg/Kg	0.292 J	0.442
Benzo(a)pyrene	mg/Kg	0.395 U	0.511
Benzo(b)fluoranthene	mg/Kg	0.37 J	0.741
Benzo(g,h,i)perylene	mg/Kg	0.2 J	0.328 J
Benzo(k)fluoranthene	mg/Kg	0.395 U	0.267 J
Chrysene	mg/Kg	0.787	0.703
Dibenzo(a,h)anthracene	mg/Kg	0.395 U	0.404 U
Fluoranthene	mg/Kg	0.333 J	0.699
Fluorene	mg/Kg	0.395 U	0.404 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.395 U	0.256 J
Naphthalene	mg/Kg	0.395 U	0.536
Phenanthrene	mg/Kg	0.676	0.904
Pyrene	mg/Kg	0.603	0.935
<b>Total Detected SVOCs</b>	<b>UNITS</b>		
Total Semi-Volatiles	mg/Kg	3.261	6.322
<b>Metals, Total</b>	<b>UNITS</b>		
Barium, Total	mg/Kg	440	212
Cadmium, Total	mg/Kg	22.3 F	33.9 F
Chromium, Total	mg/Kg	1,030	334
Lead, Total	mg/Kg	213	454
Mercury, Total	mg/Kg	0.144 U	0.173
<b>Physical Properties of Soil</b>	<b>UNITS</b>		
pH	SU	12.7	11.3

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted for Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-4**  
**SWMU 25 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25B09/DP1 6/8/98 4 8 D98-4202-1	25B09/DP2 6/8/98 8 12 D98-4202-2	25B10/DP1 9/10/97 4 7.5 D97-11023-20	25B10/DP1 9/10/97 4 7.5 D97-11023-20R2  Reanalysis	25B10A/DP1 6/8/98 4 8 D98-4202-3	25B10A/DP1D 6/8/98 4 8 D98-4202-4 Duplicate	25B12/DP1 6/8/98 0 4 D98-4202-5
Semivolatiles	UNITS							
Acenaphthene	mg/Kg	0.169 J	14.6 J*	0.391 U	3.91 DU	0.388 U	0.393 U	0.364 U
Acenaphthylene	mg/Kg	0.39 U	1.79 J	0.391 U	3.91 DU	0.388 U	0.393 U	0.364 U
Anthracene	mg/Kg	0.183 J	9.49 J*	0.391 U	3.91 DU	0.388 U	0.393 U	0.364 U
Benzo(a)anthracene	mg/Kg	0.915	9.81 J*	0.509	3.91 DU	0.136 J	0.232 J	0.364 U
Benzo(a)pyrene	mg/Kg	2.46	5.07 J*	0.488	3.91 DU	0.156 J	0.29 J	0.364 U
Benzo(b)fluoranthene	mg/Kg	1.23	9.44 J*	0.779	3.91 DU	0.232 J	0.431	0.364 U
Benzo(g,h,i)perylene	mg/Kg	5.14	3.46 J*	0.42	3.91 DU	0.235 J	0.491	0.364 U
Benzo(k)fluoranthene	mg/Kg	0.39 U	2.63 U	0.24 J	3.91 DU	0.388 U	0.393 U	0.364 U
Chrysene	mg/Kg	0.979	8.28 J*	0.511	3.91 DU	0.187 J	0.352 J	0.364 U
Dibenzo(a,h)anthracene	mg/Kg	2.42	1.49 J	0.391 U	3.91 DU	0.388 U	0.149 J	0.364 U
Fluoranthene	mg/Kg	0.249 J	19.4 J*	0.54	3.91 DU	0.159 J	0.339 J	0.364 U
Fluorene	mg/Kg	0.28 J	17.8 J*	0.391 U	3.91 DU	0.388 U	0.393 U	0.364 U
Indeno(1,2,3-cd)pyrene	mg/Kg	1.93	2.92 J*	0.32 J	3.91 DU	0.122 J	0.262 J	0.364 U
Naphthalene	mg/Kg	1.16	43.8 J*	0.234 J	3.91 DU	0.175 J	0.321 J	0.364 U
Phenanthrene	mg/Kg	1.03	34.4 J*	0.77	3.91 DU	0.205 J	0.359 J	0.364 U
Pyrene	mg/Kg	1.23	32.9 J*	1.03	3.91 DU	0.259 J	0.585	0.164 J
Total Detected SVOCs	UNITS							
Total Semi-Volatiles	mg/Kg	19.375	214.65	5.841	ND	1.866	3.811	0.164
Metals, Total	UNITS							
Arsenic, Total	mg/Kg	7.66 D	11 D	11	NA	26.6 D	19.6 D	10.6 D
Barium, Total	mg/Kg	349 D	330 D	243	NA	239 D	182 D	353 D
Cadmium, Total	mg/Kg	7.86 D	5.18 D	9.12	NA	18.6 D	20.5 D	6.55 D
Chromium, Total	mg/Kg	789 D	417 D	331	NA	641 D	391 D	817 D
Lead, Total	mg/Kg	304 D	3,040 D	451 F	NA	1,160 D	1,090 D	395 D
Mercury, Total	mg/Kg	0.0489 J	0.0963 J	0.612	NA	0.225	0.402 D	0.132 U
Selenium, Total	mg/Kg	5.91 DU	6.64 DU	1.18 U	NA	4.45 DJ	5.95 DU	5.51 DU
Silver, Total	mg/Kg	2.95 DU	3.32 DU	1.32	NA	2.94 DU	1.84 DJ	2.76 DU
Physical Properties of Soil	UNITS							
pH	SU	11.8 J*	11.4 J*	10.9	NA	11.4 J*	11.6 J*	12.1 J*

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-4**  
**SWMU 25 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		25B12/DP2 6/8/98 4 6 D98-4202-6	25B13/DP1 6/8/98 0 4 D98-4202-7	25B13/DP2 6/8/98 4 6 D98-4202-8	25B14/DP1 6/8/98 0 4 D98-4202-9	25B14/DP2 6/8/98 4 8 D98-4202-12	25B15/DP1 6/8/98 0 4 D98-4202-13
<b>Semivolatiles</b>	<b>UNITS</b>						
Acenaphthene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.379 U	0.357 U
Acenaphthylene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.379 U	0.357 U
Anthracene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.379 U	0.357 U
Benzo(a)anthracene	mg/Kg	0.118 J	0.35 U	0.35 U	0.383 U	0.232 J	0.108 J
Benzo(a)pyrene	mg/Kg	0.161 J	0.35 U	0.35 U	0.383 U	0.301 J	0.146 J
Benzo(b)fluoranthene	mg/Kg	0.178 J	0.35 U	0.142 J	0.383 U	0.317 J	0.148 J
Benzo(g,h,i)perylene	mg/Kg	0.205 J	0.11 J	0.35 U	0.383 U	0.509 J	0.166 J
Benzo(k)fluoranthene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.331 J	0.357 U
Chrysene	mg/Kg	0.206 J	0.146 J	0.134 J	0.167 J	0.327 J	0.161 J
Dibenzo(a,h)anthracene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.23 J	0.357 U
Fluoranthene	mg/Kg	0.169 J	0.35 U	0.167 J	0.383 U	0.176 J	0.118 J
Fluorene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.379 U	0.357 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.387 U	0.35 U	0.35 U	0.383 U	0.24 J	0.357 U
Naphthalene	mg/Kg	0.177 J	0.35 U	0.35 U	0.383 U	0.193 J	0.357 U
Phenanthrene	mg/Kg	0.255 J	0.179 J	0.35 U	0.165 J	0.495 J	0.169 J
Pyrene	mg/Kg	0.32 J	0.184 J	0.199 J	0.122 J	0.598 J	0.367 J*
<b>Total Detected SVOCs</b>	<b>UNITS</b>						
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>1.789</b>	<b>0.619</b>	<b>0.642</b>	<b>0.454</b>	<b>3.949</b>	<b>1.383</b>
<b>Metals, Total</b>	<b>UNITS</b>						
Arsenic, Total	mg/Kg	19.6 D	12.4 D	27.3 D	9.59 D	9.38 D	7.36 D
Barium, Total	mg/Kg	461 D	361 D	362 D	527 D	479 D	485 D
Cadmium, Total	mg/Kg	5.91 D	7.42 D	4.5 D	7.93 D	6.08 D	8.51 D
Chromium, Total	mg/Kg	1,680 D	952 D	1,210 D	1,250 D	1,460 D	1,670 D
Lead, Total	mg/Kg	312 D	291 D	263 D	485 D	608 D	432 D
Mercury, Total	mg/Kg	0.141 U	0.128 U	0.127 U	0.139 U	0.0669 J	0.054 J
Selenium, Total	mg/Kg	5.87 DU	5.35 DU	5.31 DU	5.81 DU	5.74 DU	5.41 DU
Silver, Total	mg/Kg	2.93 DU	2.68 DU	2.65 DU	1.2 DJ	2.87 DU	2.71 DU
<b>Physical Properties of Soil</b>	<b>UNITS</b>						
pH	SU	12.2 J*	12 J*	12.2	11.8	10.6 J*	12 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 19-5**  
**SWMU 25 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Results
<b>Semivolatiles</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Benzo(a)anthracene	2	25B09 / DP2	8 - 12	9.81 J*
Benzo(b)fluoranthene	5	25B09 / DP2	8 - 12	9.44 J*
Dibenzo(a,h)anthracene	2	25B09 / DP1	4 - 8	2.42
<b>Metals</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Cadmium, Total	8	25G01 / SR1	0 - 1	31.9 F
		25G02 / SR1	0 - 1	34.9 F
		25G02 / SR1D	0 - 1	28.2 F
		25G03 / SR1	0 - 1	27 F
		25G04 / SR1	0 - 1	27.8 F
		25B01 / CS1	0 - 2	39.9 F
		25B01 / CS2	2 - 4	57.9 F
		25B01 / CS3	4 - 7	29.9 F
		25B02 / CS1	0 - 2	39.8 F
		25B02 / CS2	2 - 4	45.6 F
		25B02 / CS2D	2 - 4	41.2 F
		25B02 / CS3	4 - 7	36.9 F
		25B03 / CS1	0 - 2	21.7 F
		25B03 / CS2	2 - 4	35.4 F
		25B03 / CS3	4 - 7	23.6 F
		25B04 / CS1	0 - 2	30.7 F
		25B04 / CS2	2 - 4	33.4 F
		25B04 / CS3	4 - 5	49 F
		25B05 / CS1	0 - 2	46.2 F
		25B05 / CS2	2 - 4	53 F
		25B06 / CS1	0 - 2	22.3 F
		25B06 / CS2	2 - 4	28.2 F
		25B07 / CS1	0 - 2	27.4 F
		25B07 / CS2	2 - 4	28.2 F
		25B07 / CS3	4 - 5.5	45.1 F
		25B08 / CS1	0 - 2	40.5 F
		25B08 / CS2	2 - 4	22.3 F
		25B08 / CS3	4 - 8	33.9 F
		25B10 / DP1	4 - 7.5	9.12
		25B10A / DP1	4 - 8	18.6 D
		25B10A / DP1D	4 - 8	20.5 D
		25B15 / DP1	0 - 4	8.51 D
Lead, Total	400	25G03 / SR1	0 - 1	462 J*
		25B01 / CS1	0 - 2	474
		25B01 / CS2	2 - 4	1120
		25B02 / CS1	0 - 2	911
		25B02 / CS2	2 - 4	620
		25B02 / CS2D	2 - 4	656
		25B03 / CS1	0 - 2	415
		25B03 / CS2	2 - 4	612
		25B04 / CS2	2 - 4	526
		25B04 / CS3	4 - 5	454
		25B05 / CS1	0 - 2	1200
		25B05 / CS2	2 - 4	593

**Table 19-5**  
**SWMU 25 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Results
Lead, Total (continued)	400	25B06 / CS2	2 - 4	532
		25B07 / CS1	0 - 2	487
		25B07 / CS3	4 - 5.5	527
		25B08 / CS1	0 - 2	722
		25B08 / CS3	4 - 8	454
		25B09 / DP2	8 - 12	3040 D
		25B10 / DP1	4 - 7.5	451 F
		25B10A / DP1	4 - 8	1160 D
		25B10A / DP1D	4 - 8	1090 D
		25B14 / DP1	0 - 4	485 D
		25B14 / DP2	4 - 8	608 D
		25B15 / DP1	0 - 4	432 D
Mercury, Total	2	25B04 / CS3	4 - 5	2.57

Notes:

D = Sample was diluted prior to analysis.

DAF = Dilution Attenuation Factor

F = Compound was detected in corresponding equipment rinsate blank.

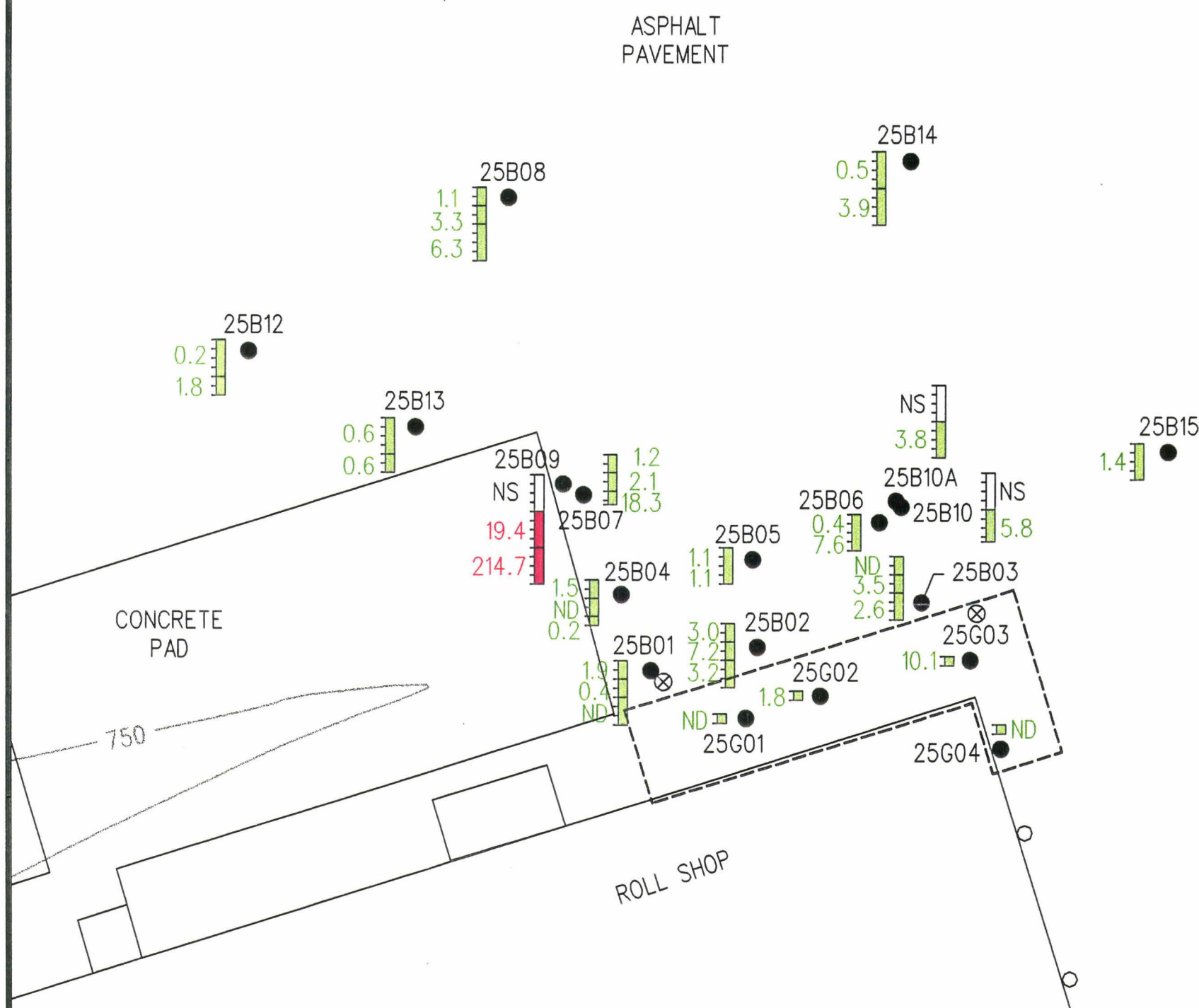
ft = feet

J\* = Qualified as estimated by BMWCI in the QC evaluation.

SSL = Soil Screening Level



PAH SOIL DETECTIONS ABOVE SSLs					
PARAMETER	SSL (mg/Kg)	SAMPLE	SAMPLE DEPTH (ft bgs)	SAMPLE RESULT (mg/Kg)	
BENZO(A)ANTHRACENE	2	25B09/DP2	8-12	9.81	J*
BENZO(B)FLUORANTHENE	5	25B09/DP2	8-12	9.44	J*
DIBENZ(A,H)ANTHRACENE	2	25B09/DP1	4-8	2.42	
QUALIFIER NOTES: J* = QUALIFIED AS ESTIMATED DURING QC EVALUATION					

**LEGEND**

- SOIL BORING LOCATION
- ⊗ APPROXIMATE SURFACE DRAIN LOCATION
- APPROXIMATE LIMITS OF SWMU 25
- 10.0 OR █ TOTAL SVOC RESULTS (mg/Kg) - ONE OR MORE SVOC DETECTIONS ABOVE SSLs (SEE INSET TABLE)
- 10.0 OR █ TOTAL SVOC RESULTS (mg/Kg) - ALL DETECTIONS BELOW SSLs
- ND NOT DETECTED
- NS NOT SAMPLED
- SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.

**NOTES:**

1. DISCRETE SURFACE SOIL SAMPLES COLLECTED DURING RFI INTERIM MEASURES (1996).
2. SOIL BORING SAMPLES COLLECTED DURING RFI INTERIM MEASURES (1996) AND PHASE 2 (1998).
3. BORING 25B11 COULD NOT BE INSTALLED DUE TO THICKNESS OF CONCRETE PAD.
4. SEE SWMU 25 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



15' 0' 15' 30'

SCALE IN FEET

**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 19-3**  
**SWMU 25 TOTAL**  
**PAH SOIL RESULTS**

ARMCO KANSAS CITY FACILITY  
GST STEEL PROPERTY



QUALIFIER NOTES:

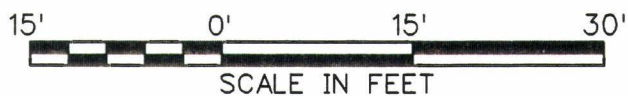
D = DILUTED SAMPLE  
F = COMPOUND DETECTED IN ASSOCIATED  
RINSATE BLANK  
J= QUALIFIED AS ESTIMATED DURING  
QC EVALUATION



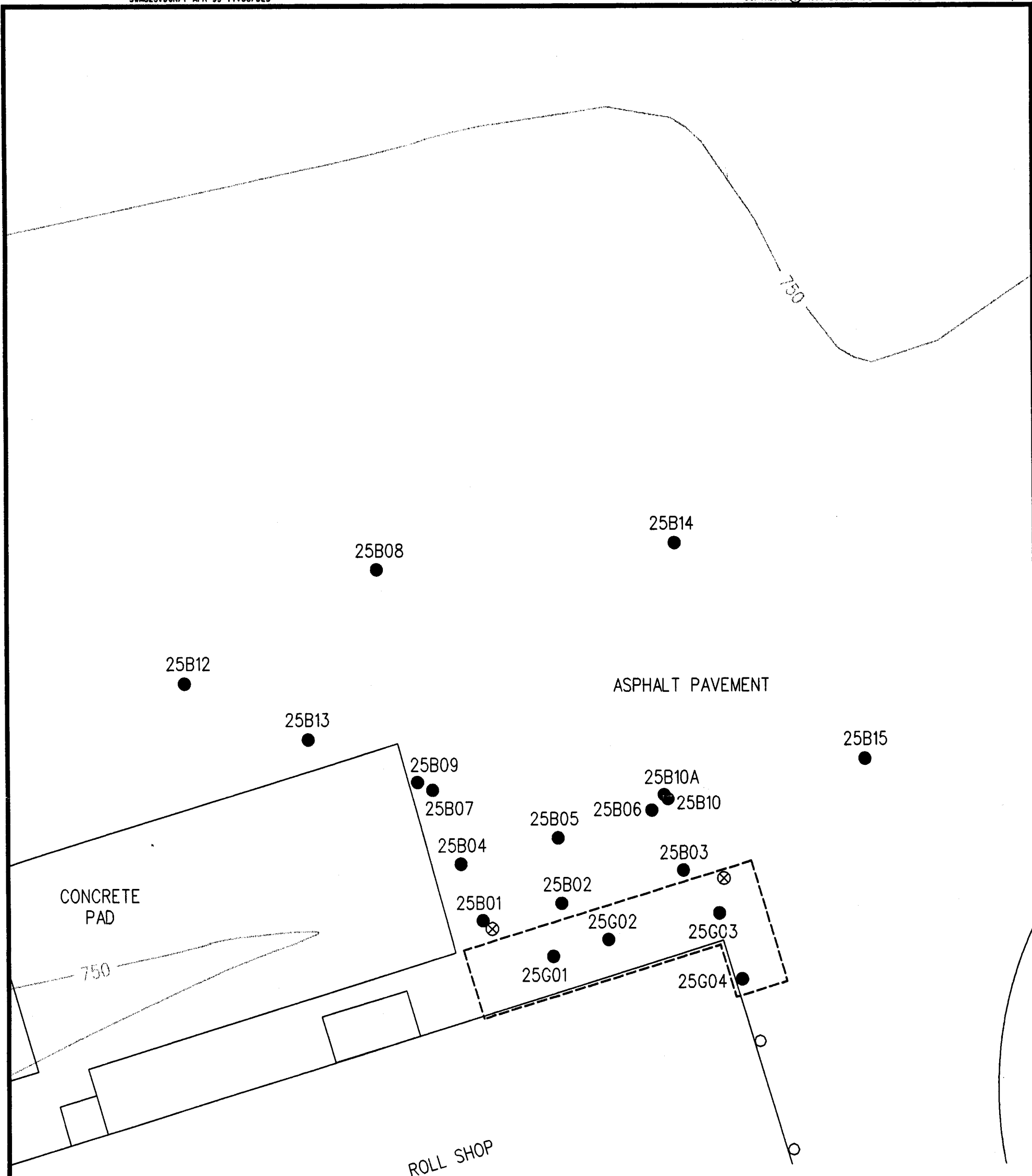
- SOIL BORING LOCATION  
 ⊗ APPROXIMATE SURFACE DRAIN LOCATION  
 --- APPROXIMATE LIMITS OF SWMU 25  
 █ LEAD AND/OR CADMIUM RESULT (mg/Kg)  
 ABOVE SSLs (SEE INSET TABLE)  
 █ LEAD AND CADMIUM RESULTS (mg/Kg)  
 BELOW SSLs  
 NS NOT SAMPLED  
 ||| SAMPLING STRATEGY: SHORTER HATCH  
 LINES INDICATE THE DEPTH BELOW  
 GROUND SURFACE WHERE EACH MARK  
 REPRESENTS AN ADDITIONAL ONE FOOT  
 OF DEPTH; LONGER HATCH LINES  
 REPRESENT THE SAMPLE DEPTH  
 INTERVALS.

**NOTES:**

1. DISCRETE SURFACE SOIL  
SAMPLES COLLECTED DURING RFI  
INTERIM MEASURES (1996).
2. SOIL BORING SAMPLES  
COLLECTED DURING RFI INTERIM  
MEASURES (1996) AND PHASE 2 (1998).
3. BORING 25B11 COULD NOT BE IN-  
STALLED DUE TO THICKNESS OF  
CONCRETE PAD.
4. SEE SWMU 25 DATA RESULTS  
TABLES FOR ADDITIONAL SAMPLE  
INFORMATION.



**Figure 19-2**  
**SWMU 25 LEAD AND**  
**CADMIUM SOIL RESULTS**  
ARMCO KANSAS CITY FACILITY  
GST STEEL PROPERTY



**LEGEND**

- SOIL BORING LOCATION
- ⊗ APPROXIMATE SURFACE DRAIN LOCATION
- APPROXIMATE LIMITS OF SWMU 25



**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 19-1**  
**SWMU 25 SOIL**  
**SAMPLING LOCATIONS**  
ARMCO INC., KANSAS CITY, MISSOURI  
GST STEEL PROPERTY



**SWMU 26**  
**ROD MILL DRUM STORAGE AREAS**  
**(GST PROPERTY)**

## **20.0 SWMU 26 – ROD MILL DRUM STORAGE AREAS**

### **20.1 SWMU BACKGROUND**

#### **20.1.1 Description of SWMU**

The Rod Mill Drum Storage Area (SWMU 26), located on GST property (see Figure 1-2), was used by Armco for the storage of waste oil drums from the mid-1980s to 1993. During this period, waste oil (waste hydraulic and waste lubricating oil from the Rod Mill) was accumulated in the area prior to being transported to the Waste Oil Storage Area (SWMU 24). From review of photographs taken during the visual site inspection, as many as 30 to 40 drums of waste oil may have been stored at this location at one time. The defined SWMU area is approximately 15 feet by 75 feet (less than 0.03 acres) in size.

Armco's drum storage activities at SWMU 26 ended in July of 1993 when revised procedures for waste oil handling were implemented. Armco's control over activities at this SWMU ceased when the property was transferred to GST in November of 1993. GST now stores waste oil on spill containment pallets at various locations on GST property prior to collection for off-site recycling/disposal.

During the visual site inspection in 1991, stained soils were observed at SWMU 26. In 1994, GST constructed an extension to the Rod Mill Building which covers the area where the waste oil drums had been stored. The soil in the area was visually observed by an Armco representative during excavation activities at the time of the construction, and no signs of contamination were observed. The area has been covered with concrete for the floor of the building.

Based on the types of materials stored at SWMU 26 prior to the property transfer to GST, the primary contaminants of potential concern were petroleum hydrocarbons associated with waste oil and heavy metals (possibly present in waste hydraulic and lubricating oil).

SWMU 26 was identified in the Permit as an IM SWMU. IM activities completed at this SWMU are summarized in Section 20.2.

#### **20.1.2 Release Potential**

The primary release potential for this SWMU was to the surrounding soils. No documented spills are known to have occurred at this location.

### **20.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment was assessed through the collection of subsurface soil samples. Table 20-1 and Figure 20-1 present a summary of the investigation activities for SWMU 26. During the interim measures investigation, two soil borings were advanced, and two soil samples were collected from each soil boring at two to four and four to seven feet bgs. Since excavation activities had taken place at this SWMU, the top interval of zero to two feet was not sampled. Soil samples were analyzed for PAHs, TPH, and RCRA metals.

### **20.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Table 20-2 and Figures 20-2 and 20-3 present the analytical results for SWMU 26. TPH results are presented in Appendix U.

#### **20.3.1 Metals**

The nature and extent of metals was adequately characterized at SWMU 26. All metal detections were below their respective 20 DAF SSLs. Barium was detected in all of the samples; concentrations ranged from 130 to 170 mg/Kg. Cadmium was detected in all of the samples; concentrations ranged from 2.85 to 3.28 mg/Kg. Cadmium was also detected in the associated equipment rinsate blank, which indicates potential high bias in the field sample results. Chromium was detected in all of the samples; concentrations ranged from 9.81 to 11.1 mg/Kg. Silver was detected in the upper interval of Boring 26B02, at an estimated concentration of 0.78 J mg/Kg. Arsenic, lead, mercury, and selenium were not detected in the samples.

### **20.3.2 PAHs**

PAHs were not detected in any of the soil samples. Therefore, the nature and extent of PAHs was adequately characterized at SWMU 26.

## **20.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 26, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers). SWMU 26 is located inside the Rod Mill, which contains a concrete floor. Therefore, storm water runoff, surface water transport, and airborne dust transport are not considered pathways for constituent migration at SWMU 26.

The nature and extent of contamination at SWMU 26 was assessed through the collection of subsurface soil samples. Metals were detected at low concentrations (below 20 DAF SSLs based on soil transfer to groundwater) and PAHs were not detected. The slightly basic to basic pH soil conditions at the Facility and the presence of the building structure and concrete floor that prevent storm water infiltration limit the potential for vertical migration in soil. Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Therefore, constituent migration via soil transfer to groundwater, storm sewer transport, and groundwater transport is not expected for SWMU 26.

## **20.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted for SWMU 26.

### **20.5.1 Human Health Evaluation**

Since no chemicals were detected at concentrations exceeding risk screening levels, further human health risk evaluation was not conducted for SWMU 26.

### **20.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 26. Therefore, and ecological risk evaluation was not conducted for SWMU 26.

### **20.6 SUMMARY**

SWMU 26, located in the western portion of the Facility, is a former waste oil drum storage area. The defined SWMU area is approximately 15 feet by 75 feet (less than 0.03 acres) in size. Four subsurface soil samples were collected at SWMU 26. As shown on Figures 20-2 and 20-3, SWMU 26 was adequately characterized by the analytical data collected. All detected concentrations of RCRA metals were below 20 DAF SSLs, and PAHs were not detected. Therefore, the nature and extent of contamination at SWMU 26 was adequately defined.

Potential migration pathways at SWMU 26 include soil transfer to groundwater, groundwater transport, and storm sewer transport. Subsurface soil samples showed no detections of metals or PAHs that exceeded 20 DAF SSLs (based on soil migration to groundwater). Based on the data and the location of the SWMU inside the Rod Mill building (with concrete flooring), constituent migration via soil transfer to groundwater, groundwater transport, and storm sewer transport is not expected for SWMU 26.

A risk evaluation was conducted for SWMU 26. For the human health evaluation, no COPCs were identified. Therefore, further human health risk evaluation was not performed. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 26.

\* \* \* \* \*

**Table 20-1**  
**SWMU 26 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis			Comments	Lab ID Number
Point	Designator				PAH	TPH	RCRA Metals		
SOIL BORING SAMPLES									
26B01	CS1	2 - 4	11/4/96	IM	X	X	X	Matrix Spike Matrix Spike Duplicate	D96-12547-27
	CS2	4 - 7	11/4/96	IM	X	X	X		D96-12547-28
	CS2MS	4 - 7	11/4/96	IM	X		X		D96-12547-29
	CS2MSD	4 - 7	11/4/96	IM	X		X		D96-12547-30
26B02	CS1	2 - 4	11/4/96	IM	X	X	X	Field Duplicate  Rinsate	D96-12547-31
	CS1D	2 - 4	11/4/96	IM	X	X	X		D96-12547-32
	CS2	4 - 7	11/4/96	IM	X	X	X		D96-12547-33
	CS2R		11/4/96	IM	X	X	X		D96-12547-34

**Notes:**

ft = feet

IM = Interim Measures

PAH = Polyaromatic Hydrocarbons

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

**Table 20-2**  
**SWMU 26 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		26B01/CS1 11/04/1996 2 4 D96-12547-27	26B01/CS2 11/04/1996 4 7 D96-12547-28	26B02/CS1 11/04/1996 2 4 D96-12547-31	26B02/CS1D 11/04/1996 2 4 D96-12547-32 Duplicate	26B02/CS2 11/04/1996 4 7 D96-12547-33
<b>Semivolatiles</b>	UNITS					
Acenaphthene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Acenaphthylene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Anthracene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Benzo(a)anthracene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Benzo(a)pyrene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Benzo(b)fluoranthene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Benzo(g,h,i)perylene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Benzo(k)fluoranthene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Chrysene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Dibenzo(a,h)anthracene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Fluoranthene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Fluorene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Naphthalene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Phenanthrene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
Pyrene	mg/Kg	0.406 U	0.435 U	0.397 U	0.43 U	0.426 U
<b>Total Detected SVOCs</b>	UNITS					
<b>Total Semi-Volatiles</b>	mg/Kg	ND	ND	ND	ND	ND
<b>Metals, Total</b>	UNITS					
Arsenic, Total	mg/Kg	12.3 U	13.2 U	12 U	13 U	12.9 U
Barium, Total	mg/Kg	155	145	130	170	140
Cadmium, Total	mg/Kg	2.85 F	3.13 F	2.98 F	3.21 F	3.28 F
Chromium, Total	mg/Kg	9.81	11.1	10.6	11	10.9
Lead, Total	mg/Kg	12.3 U	13.2 U	12 U	13 U	12.9 U
Mercury, Total	mg/Kg	0.148 U	0.158 U	0.144 U	0.156 U	0.155 U
Selenium, Total	mg/Kg	30.8 U	33 U	30 U	32.6 U	32.3 U
Silver, Total	mg/Kg	1.23 U	1.32 U	0.78 J	1.3 U	1.29 U

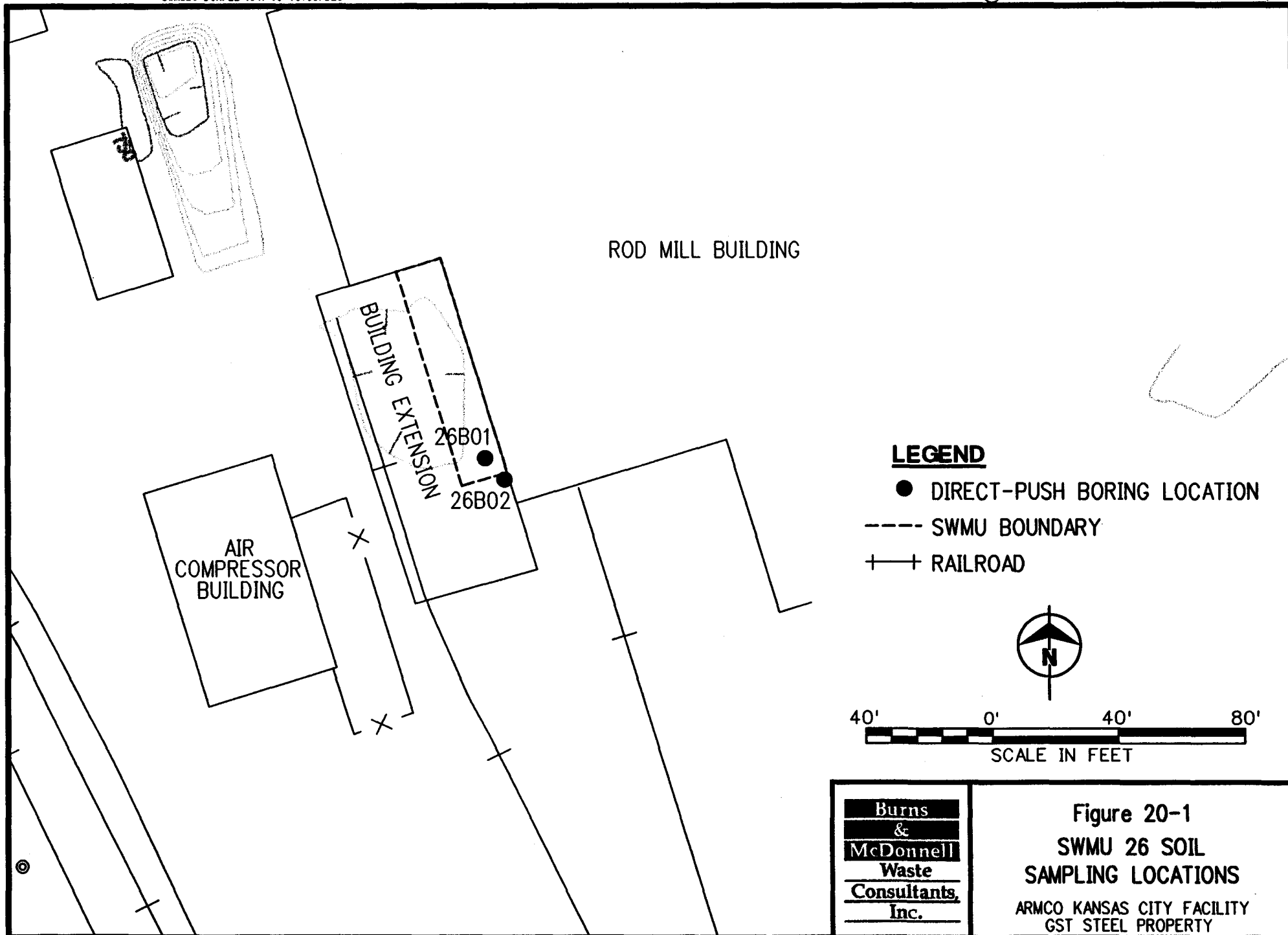
**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

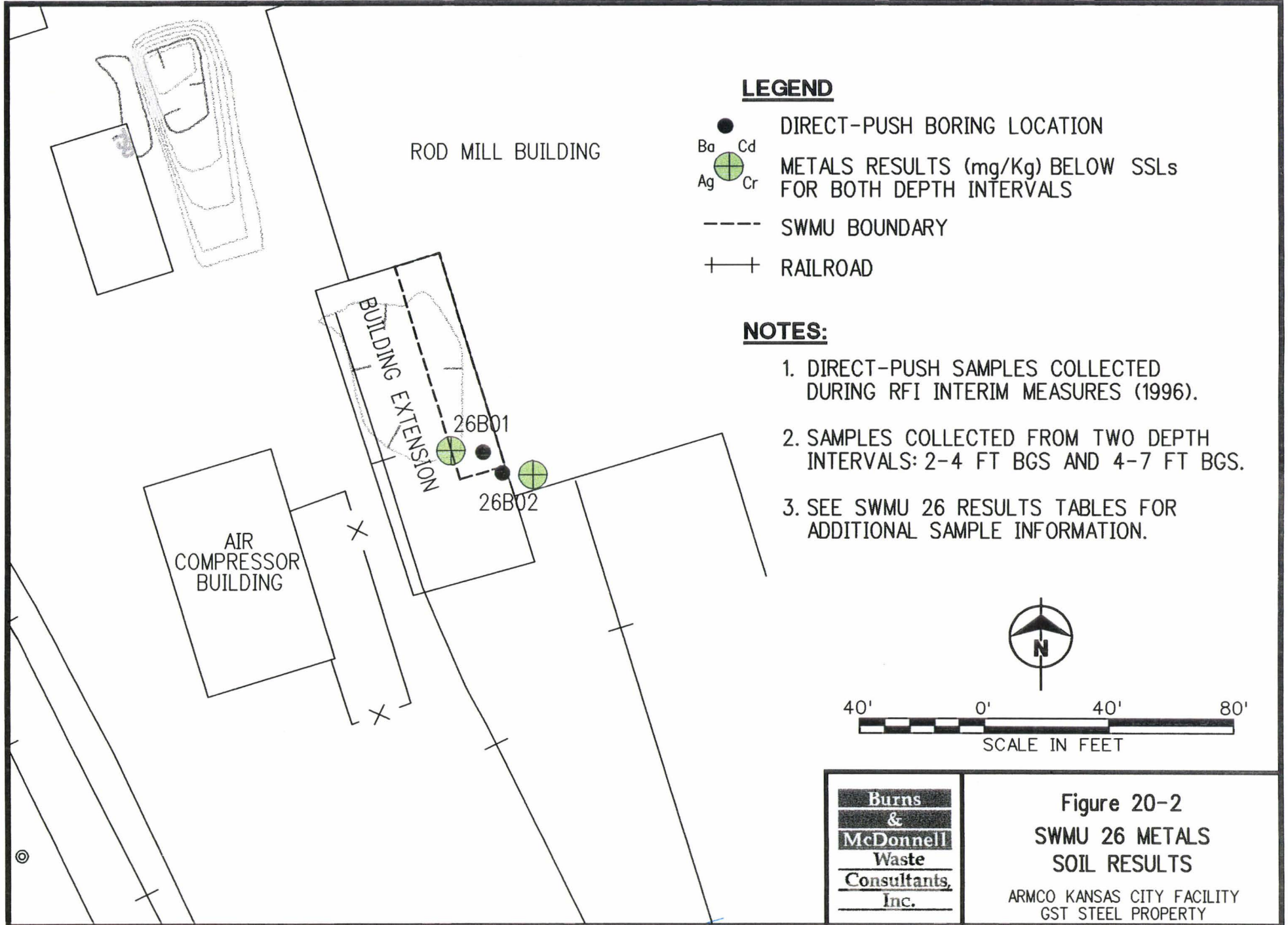
F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
NA - Not Analyzed

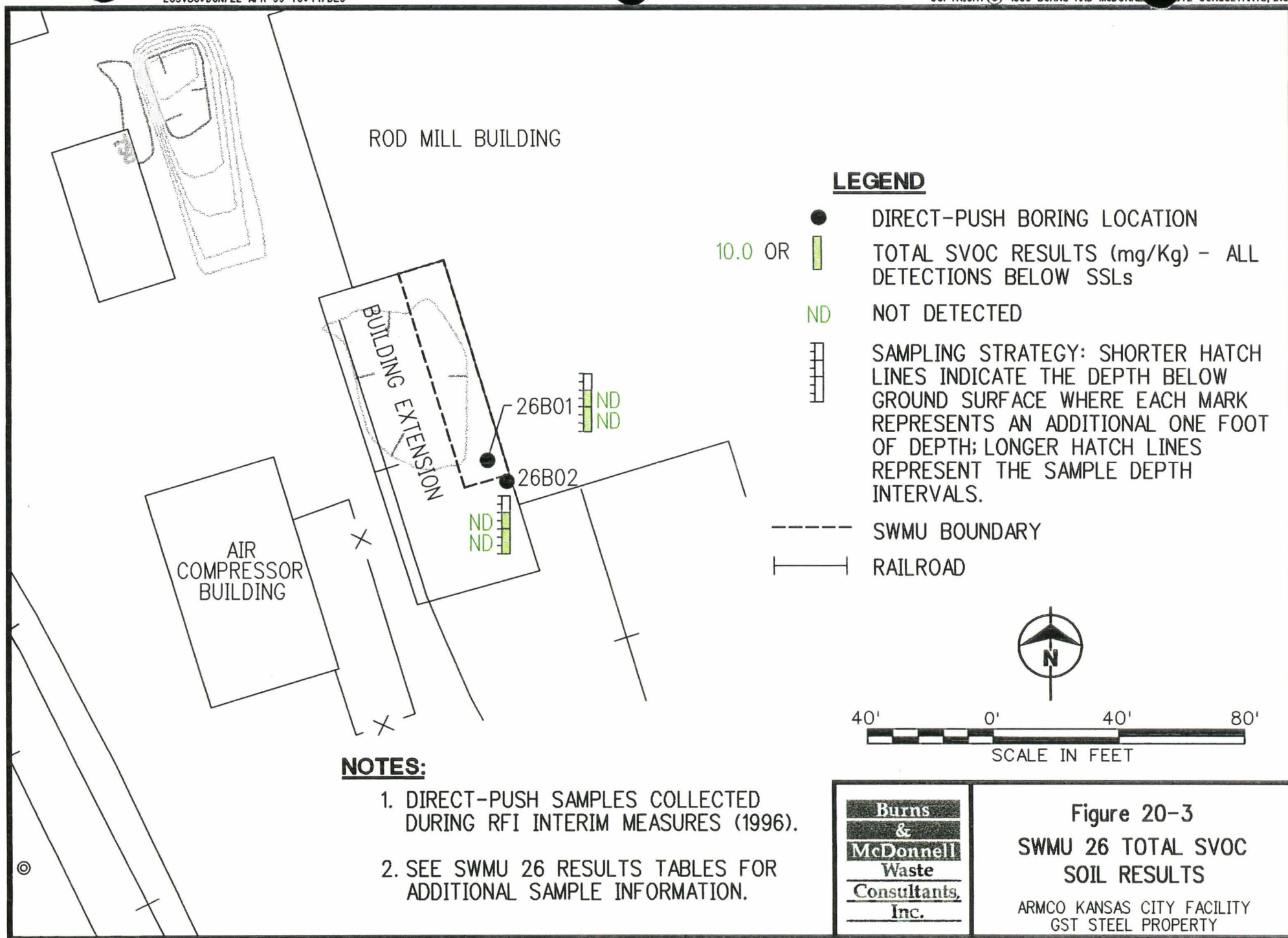
J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation









**SWMU 27**  
**BAR JOIST BUILDING HAZARDOUS WASTE STORAGE AREA**  
**(GST PROPERTY)**

**Table 21-1**  
**SWMU 27 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis							Comments	Lab ID Number
Point	Designator					Total		VOC	PAH	TPH	RCRA Metals	pH		
						Lead	Cadmium							
DIRECT-PUSH SUBSURFACE SOIL SAMPLES														
27B01	DP1	1 - 3	3/31/97	1				X		X	X	X	Field Duplicate	D97-3890-1
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-2
	DP2D	3 - 5	3/31/97	1				X		X	X	X		D97-3890-3
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-4
27B02	DP1	1 - 3	3/31/97	1				X		X	X	X	Rinsate	D97-3890-5
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-6
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-7
	DP3R		3/31/97	1				X		X	X	X		D97-3890-8
27B03	DP1	1 - 3	3/31/97	1				X		X	X	X	Matrix Spike Matrix Spike Duplicate	D97-3890-9
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-10
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-11
	DP3MS	5 - 7	3/31/97	1				X			X			D97-3890-12
	DP3MSD	5 - 7	3/31/97	1				X			X			D97-3890-14
27B04	DP1	0.5 - 2	6/1/98	2	X	X	X						Field Duplicate	D984147-1
	DP2	2 - 3	6/1/98	2	X	X	X							D984147-2
	DP3	3 - 4	6/1/98	2	X	X	X							D984147-3
	DP3D	3 - 4	6/1/98	2	X	X	X							D984147-4
	DP4	4 - 5	6/1/98	2	X	X	X							D984147-5
	DP5	5 - 6	6/1/98	2	X	X	X							363834
	DP6	6 - 7	6/1/98	2	X	X	X							363835
27B05	DP1	0.5 - 1	6/1/98	2	X	X	X						Rinsate	D984147-6
	DP1R		6/1/98	2		X	X							D984147-11
	DP2	1 - 2	6/1/98	2	X	X	X							D984147-7
	DP2MS	1 - 2	6/1/98	2	X	X	X						D984147-8	
	DP2MSD	1 - 2	6/1/98	2	X	X	X						D984147-9	
	DP3	2 - 3	6/1/98	2	X	X	X						D984147-10	

**Notes:**

ft = feet

PAH = Polyaromatic Hydrocarbons

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

XRF = X-Ray Fluorescence Spectroscopy

**Table 21-2**  
**SWMU 27 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		27B01/DP1 3/31/1997 1 3 D97-3890-1	27B01/DP2 3/31/1997 3 5 D97-3890-2	27B01/DP2D 3/31/1997 3 5 D97-3890-3 Duplicate	27B01/DP3 3/31/1997 5 7 D97-3890-4	27B02/DP1 3/31/1997 1 3 D97-3890-5	27B02/DP2 3/31/1997 3 5 D97-3890-6	27B02/DP3 3/31/1997 5 7 D97-3890-7
<b>Volatiles</b>	<b>UNITS</b>							
1,1-Dichloroethane	ug/Kg	5.31 U	5.3 U	5.25 U	10	5.35 U	5.93 U	9.94
Tetrachloroethene	ug/Kg	5.31 U	5.3 U	5.25 U	5.26 U	5.35 U	5.93 U	6.91 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	ND	ND	ND	10	ND	ND	9.94
<b>Metals, Total</b>	<b>UNITS</b>							
Arsenic, Total	mg/Kg	1.45 J	10.6 U	1.2 J	1.41 J	2.13 J	7.86 J	8.93 J
Barium, Total	mg/Kg	197 J*	20.5 J*	176 J*	175 J*	238 J*	210 J*	401 J*
Cadmium, Total	mg/Kg	2.13 UJ*	2.12 UJ*	2.1 UJ*	2.1 UJ*	2.52 J*	1.62 J	2.76 UJ*
Chromium, Total	mg/Kg	11.5 J*	2.12 UR	5.12 J*	6.77 J*	37.4 J*	44.8 J*	91 J*
Lead, Total	mg/Kg	7.4 J	10.6 UJ*	10.5 UJ*	10.5 UJ*	82.2 J*	52.8 J*	34.1 J*
Selenium, Total	mg/Kg	1.22 J	26.5 U	1.14 J	1.46 J	1.15 J	29.7 U	34.5 U
Silver, Total	mg/Kg	0.87 J	1.06 U	0.83 J	0.84 J	1.03 J	1.19 U	1.38 U
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	8.8 J*	8.7 J*	8.7 J*	8.6 J*	8.6 J*	9.7 J*	8.7 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

## **21.0 SWMU 27 – BAR JOIST BUILDING HAZARDOUS WASTE STORAGE AREA**

### **21.1 SWMU BACKGROUND**

#### **21.1.1 Description of SWMU**

The Bar Joist Building Hazardous Waste Storage Area (SWMU 27), located on GST property (see Figure 1-2), consisted of an area used for the temporary (less than 90 day) storage of hazardous waste prior to transport off site for treatment and disposal. The majority of the activity at this SWMU occurred between 1982 and 1984. However, drums of waste were also stored at this location on one occasion in 1987. The SWMU occupied an area approximately 30 feet by 60 feet within the Bar Joist Building. Throughout its operation, this SWMU was active on an as-needed basis rather than a continuous basis. At many times, the only items present at the SWMU were empty drums. The area where the SWMU was located is covered with concrete. However, the possibility exists that the concrete cover was not present throughout all of the SWMU's active life. The defined SWMU area is approximately 85 feet by 30 feet (less than 0.06 acres) in size.

Wastes stored at the SWMU may have been hazardous by either listing or characteristic. Wastes which may have been stored at the SWMU included paint sludges, solvents (TCE and possibly 1,1,1-TCA), metals, and/or corrosive liquids and solids (including caustic sludge). Based on the types of materials handled at SWMU 27 prior to the property transfer to GST, the primary constituents of potential concern were VOCs, heavy metals, and corrosive materials that affect pH.

#### **21.1.2 Release Potential**

The primary release potential for this SWMU was to the surrounding soils. There are no records of any spills or releases associated with this SWMU.

## **21.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment was assessed through the collection of subsurface soil samples. Table 21-1 presents a summary of the investigation activities at SWMU 27. Figure 21-1 shows the sampling locations for SWMU 27. Based on new information obtained during RFI Phase 1 concerning the actual SWMU location, boring locations were moved just east of the SWMU boundary as presented in the RFI Workplan. Borings were placed on the eastern side of a former machine pit at the location where drums were formerly stored.

Eighteen soil samples were collected from below the concrete pad at SWMU 27. Three direct-push borings (27B01 through 27B03) were installed during RFI Phase 1. Soil samples were collected from three depth intervals (1 to 3, 3 to 5, and 5 to 7 feet bgs) and analyzed for VOCs, TPH, RCRA metals, and pH. During RFI Phase 2, two additional direct-push borings (27B04 and 27B05) were installed. Soil samples were collected from three to six depth intervals (0.5 to 1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, 5 to 6, and/or 6 to 7 feet bgs) and analyzed for lead and cadmium. The RFI Phase 2 soil samples were field screened for lead using XRF spectroscopy. All samples screened using XRF were subsequently sent to the analytical lab.

## **21.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Table 21-2 summarizes the analytical results for SWMU 27. Figures 21-2 and 21-3 present the metals, pH, and VOC results respectively. TPH results are presented in Appendix U.

### **21.3.1 Metals and pH**

All of the samples exhibited slightly basic or basic pH values. Samples from Borings 27B01 and 27B02 contained pH values that ranged from pH 8.6 to 9.7. The pH for samples from Boring 27B03 decreased from a high of pH 12.1 in the upper-most sampling interval to a low of pH 9.3 in the deepest sampling interval.

With the exception of mercury, all of the RCRA metals were detected in the samples collected at SWMU 27. However, none of the arsenic, barium, chromium, selenium, or silver detections

exceeded the 20 DAF SSLs; the highest concentrations for each of these metals were 12.9, 476 J\*, 815 J\*, 3.45 J, and 3.09 mg/Kg, respectively.

Cadmium was detected below the 20 DAF SSL (8 mg/Kg) in 10 of the 18 samples analyzed. Cadmium was detected in samples from all borings except Boring 27B01. The highest cadmium concentration, 63 DJ\* mg/Kg, was encountered in the second depth interval (1 to 2 feet bgs) at Boring 27B05. The remaining seven cadmium 20 DAF SSL exceedences ranged from 8.06 J\* to 22.2 DJ\* mg/Kg.

Lead was detected in samples collected from each boring. Lead was detected below the 20 DAF SSL (400 mg/Kg) in 13 of the 18 samples collected at SWMU 27. The highest lead concentration, 1,460 D mg/Kg, was encountered in the second depth interval (1 to 2 feet bgs) at Boring 27B05. The remaining four lead 20 DAF SSL exceedences ranged from 441 D to 547 J\* mg/Kg.

Figure 21-2 presents the metals results and highlights locations with 20 DAF SSL exceedences. Table 21-3 presents the soil results that exceeded the 20 DAF SSL. Since no 20 DAF SSL exceedences were noted for arsenic, barium, chromium, selenium, and silver, the horizontal and vertical extent of detections for these metals were well defined by the boring locations. For cadmium and lead, no exceedences of 20 DAF SSLs were noted in the northern and western sampling locations (Borings 27B01 and 27B02). Cadmium and/or lead slightly exceeded the 20 DAF SSLs in the upper soil depth intervals collected in the central and southern portions of the sampling area (Borings 27B03 and 27B04). The 20 DAF SSLs for cadmium and lead were also exceeded in the easternmost sampling location (Boring 27B05). Therefore, horizontal extent for cadmium and lead was well defined to the north and west and less clearly defined to the south and east. Due to equipment failure and direct-push refusal encountered near eastern Boring 27B05, further sampling for horizontal and vertical extent definition could not be implemented. In general, the cadmium and lead concentrations decreased with increasing sample depth, and no 20 DAF SSL exceedences were noted in the deepest sample intervals. Therefore, the vertical extent for cadmium and lead was adequately defined, and was limited to 5 feet bgs in Borings 27B03 and 27B04, and 2 feet bgs in Boring 27B05.



### **21.3.2 VOCs**

VOC analysis was performed only on samples from the three Phase 1 borings. VOCs were not detected in six of the nine samples submitted for analysis. Of the three samples with VOC detections, no individual detections exceeded their respective 20 DAF SSLs. 1,1-DCA was detected at low concentrations ( $\leq 10 \mu\text{g/Kg}$ ) in samples from the deepest interval (5 to 7 feet bgs) in the northern and western Borings 27B01 and 27B02. PCE ( $10.9 \mu\text{g/Kg}$ ) was detected in samples from the upper-most interval (1 to 3 feet bgs) at Boring 27B03 in the central portion of the sampling area. As shown on Figure 21-3, the nature and extent of VOCs was adequately characterized at SWMU 27.

### **21.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 27, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers). SWMU 27 is located inside the Bar Joist Building, which contains a concrete floor. Therefore, storm water runoff, surface water transport, and airborne dust transport are not considered pathways for constituent migration at SWMU 27.

The nature and extent of contamination at SWMU 27 was assessed through the collection of subsurface soil samples. Lead and cadmium concentrations in subsurface soil samples exceeded the 20 DAF SSLs (based on soil migration to groundwater) to a depth of 5 feet bgs (approximate deepest elevation 747 feet above MSL). VOCs were also detected, but these detections did not exceed 20 DAF SSLs. Based on the concrete floor cover (that limit storm water infiltration) and the slightly basic to basic soil pH conditions (8.6 to 9.7) at SWMU 27, soil transfer to groundwater and storm sewer transport are not expected to be significant. Groundwater was not encountered during subsurface soil sampling at SWMU 27 and groundwater samples were not collected. Based on groundwater information from SWMU 33 and AOC 1 (located just west and southwest of SWMU 27, respectively), the saturated zone is typically encountered at approximate elevations ranging from 737 to 739 feet above MSL. Based on the vertical definition of subsurface soil constituents at depths shallower than the saturated zone, the groundwater transport pathway is not expected to be significant for SWMU 27.

## **21.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted for SWMU 27.

### **21.5.1 Human Health Evaluation**

Lead in surface soil (i.e. samples collected less than 1 foot bgs) and lead and arsenic in subsurface soil exceeded risk screening levels. A HHRA and lead modeling were conducted for SWMU 27 to evaluate potential health risks to existing and/or possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the chemicals of concern detected in soil at SWMU 27. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.

### **21.5.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 27. Therefore, an ecological risk evaluation was not conducted for SWMU 27.

## **21.6 SUMMARY**

SWMU 27, located in the western portion of the Facility, was an area located inside the Bar Joist Building utilized for temporary storage of hazardous waste prior to transport off site for treatment and disposal. The defined SWMU area is approximately 85 feet by 30 feet (less than 0.06 acres) in size. Subsurface soil samples were collected to the east of the defined SWMU boundary in an area approximately 45 feet by 35 feet in size. Figures 21-2 and 21-3 summarize the extent of RCRA metals and VOC detections, respectively, at SWMU 27.

Nine subsurface soil sample were collected for pH, RCRA metals, and VOC analyses during Phase 1, and an additional nine subsurface soil samples were collected in Phase 2 for lead and

cadmium analysis. Soil samples exhibited slightly basic to basic pH values, ranging from 8.6 to 12.1. Cadmium and lead were the only RCRA metals that had detections above the 20 DAF SSLs, with concentrations ranging up to 63 DJ\* and 1,460 D mg/Kg, respectively. No 20 DAF SSL exceedences were noted in the deepest sampling intervals; therefore, the vertical extent of cadmium and lead was defined between 2 to 5 feet bgs. The horizontal extent of cadmium and lead was adequately defined to the north and west of the sampling area, and was less clearly defined in the southern and eastern portions of the sampling area. Direct-push refusal and equipment failure limited further sampling in the area.

Only limited detections of VOCs occurred in three soil samples, and included 1,1-DCA and PCE. None of these detections exceeded their 20 DAF SSLs. Therefore, the nature and extent of VOCs was adequately defined at SWMU 27.

Potential migration pathways at SWMU 27 include soil transfer to groundwater, groundwater transport, and storm sewer transport. Subsurface soil detections of cadmium and lead exceeded 20 DAF SSLs (based on soil migration to groundwater). Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. Based on the building structure and the concrete floor that prevent storm water infiltration, the tendencies of metals to strongly adsorb to soil rather than to migrate vertically or with groundwater movement, and the slightly basic soil pH conditions at SWMU 27, these pathways are not expected to be significant for SWMU 27.

A risk evaluation was conducted for SWMU 27. For the human health evaluation, lead was identified as a COPC in surface and subsurface soil, and arsenic was identified as a COPC in subsurface soil. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to existing and/or possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by lead in soil at SWMU 27 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 27.

\* \* \* \* \*

**Table 21-1**  
**SWMU 27 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis							Comments	Lab ID Number
Point	Designator					Total		VOC	PAH	TPH	RCRA Metals	pH		
						Lead	Cadmium							
DIRECT-PUSH SUBSURFACE SOIL SAMPLES														
27B01	DP1	1 - 3	3/31/97	1				X		X	X	X	Field Duplicate	D97-3890-1
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-2
	DP2D	3 - 5	3/31/97	1				X		X	X	X		D97-3890-3
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-4
27B02	DP1	1 - 3	3/31/97	1				X		X	X	X	Rinsate	D97-3890-5
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-6
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-7
	DP3R		3/31/97	1				X		X	X	X		D97-3890-8
27B03	DP1	1 - 3	3/31/97	1				X		X	X	X	Matrix Spike Matrix Spike Duplicate	D97-3890-9
	DP2	3 - 5	3/31/97	1				X		X	X	X		D97-3890-10
	DP3	5 - 7	3/31/97	1				X		X	X	X		D97-3890-11
	DP3MS	5 - 7	3/31/97	1				X			X			D97-3890-12
	DP3MSD	5 - 7	3/31/97	1				X			X			D97-3890-14
27B04	DP1	0.5 - 2	6/1/98	2	X	X	X						Field Duplicate	D984147-1
	DP2	2 - 3	6/1/98	2	X	X	X							D984147-2
	DP3	3 - 4	6/1/98	2	X	X	X							D984147-3
	DP3D	3 - 4	6/1/98	2	X	X	X							D984147-4
	DP4	4 - 5	6/1/98	2	X	X	X							D984147-5
	DP5	5 - 6	6/1/98	2	X	X	X							363834
	DP6	6 - 7	6/1/98	2	X	X	X							363835
27B05	DP1	0.5 - 1	6/1/98	2	X	X	X						Rinsate	D984147-6
	DP1R		6/1/98	2		X	X							D984147-11
	DP2	1 - 2	6/1/98	2	X	X	X							D984147-7
	DP2MS	1 - 2	6/1/98	2	X	X	X						D984147-8	
	DP2MSD	1 - 2	6/1/98	2	X	X	X						D984147-9	
	DP3	2 - 3	6/1/98	2	X	X	X						D984147-10	

**Notes:**

ft = feet

PAH = Polyaromatic Hydrocarbons

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

XRF = X-Ray Fluorescence Spectroscopy

**Table 21-2**  
**SWMU 27 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		27B03/DP1 3/31/1997 1 3 D97-3890-9	27B03/DP2 3/31/1997 3 5 D97-3890-10	27B03/DP3 3/31/1997 5 7 D97-3890-11	27B04/DP1 6/1/1998 0.5 2 D98-4147-1	27B04/DP2 6/1/1998 2 3 D98-4147-2	27B04/DP3 6/1/1998 3 4 D98-4147-3	27B04/DP3D 6/1/1998 3 4 D98-4147-4 Duplicate
<b>Volatiles</b>	UNITS							
1,1-Dichloroethane	ug/Kg	5.61 U	5.74 U	7.03 U	NA	NA	NA	NA
Tetrachloroethene	ug/Kg	10.9	5.74 U	7.03 U	NA	NA	NA	NA
<b>Total Detected VOCs</b>	UNITS							
<b>Total Volatiles</b>	ug/Kg	10.9	ND	ND	NA	NA	NA	NA
<b>Metals, Total</b>	UNITS							
Arsenic, Total	mg/Kg	9.73 J	12.9	8.7 J	NA	NA	NA	NA
Barium, Total	mg/Kg	449 J*	476 J*	203 J*	NA	NA	NA	NA
Cadmium, Total	mg/Kg	19.4 J*	17.5 J*	7.16 J*	8.06 DJ*	13.5 DJ*	12.1 DJ*	12.9 DJ*
Chromium, Total	mg/Kg	815 J*	734 J*	171 J*	NA	NA	NA	NA
Lead, Total	mg/Kg	526 J*	547 J*	203 J*	291 D	456 D	397 D	441 D
Selenium, Total	mg/Kg	3.28 J	3.45 J	35.2 U	NA	NA	NA	NA
Silver, Total	mg/Kg	3.09	3.01	1.29 J	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	UNITS							
pH	SU	12.1 J*	11.6 J*	9.3 J*	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 21-2**  
**SWMU 27 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		27B04/DP4	27B04/DP5	27B04/DP6	27B05/DP1	27B05/DP2	27B05/DP3
Date Sampled:		6/1/1998	6/1/1998	6/1/1998	6/1/1998	6/1/1998	6/1/1998
Sample Depth From:		4	5	6	0.5	1	2
Sample Depth To:		5	6	7	1	2	3
Laboratory Number:		D98-4147-5	363834	363835	D98-4147-6	D98-4147-7	D98-4147-10
Sample Type:							
<b>Volatiles</b>	UNITS						
1,1-Dichloroethane	ug/Kg	NA	NA	NA	NA	NA	NA
Tetrachloroethene	ug/Kg	NA	NA	NA	NA	NA	NA
<b>Total Detected VOCs</b>	UNITS						
<b>Total Volatiles</b>	ug/Kg	NA	NA	NA	NA	NA	NA
<b>Metals, Total</b>	UNITS						
Arsenic, Total	mg/Kg	NA	NA	NA	NA	NA	NA
Barium, Total	mg/Kg	NA	NA	NA	NA	NA	NA
Cadmium, Total	mg/Kg	11.7 DJ*	2.3	1.4	22.2 DJ*	63 DJ*	1.26 J*
Chromium, Total	mg/Kg	NA	NA	NA	NA	NA	NA
Lead, Total	mg/Kg	333 D	204 F	161 F	521 D	1,460 D	262
Selenium, Total	mg/Kg	NA	NA	NA	NA	NA	NA
Silver, Total	mg/Kg	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	UNITS						
pH	SU	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 21-3**  
**SWMU 27 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Cadmium, Total	8	27B03 / DP1	1 - 3	19.4 J*
		27B03 / DP2	3 - 5	17.5 J*
		27B04 / DP1	0.5 - 2	8.06 J*
		27B04 / DP2	2 - 3	13.5 J*
		27B04 / DP3	3 - 4	12.1 J*
		27B04 / DP3D	3 - 4	12.9 J*
		27B04 / DP4	4 - 5	11.7 J*
		27B05 / DP1	0.5 - 1	22.2 DJ*
		27B05 / DP2	1 - 2	63 DJ*
Lead, Total	400	27B03 / DP1	1 - 3	526 J*
		27B03 / DP2	3 - 5	547 J*
		27B04 / DP2	2 - 3	456 D
		27B04 / DP3D	3 - 4	441 D
		27B05 / DP1	0.5 - 1	521 D
		27B05 / DP2	1 - 2	1,460 D

**Notes:**

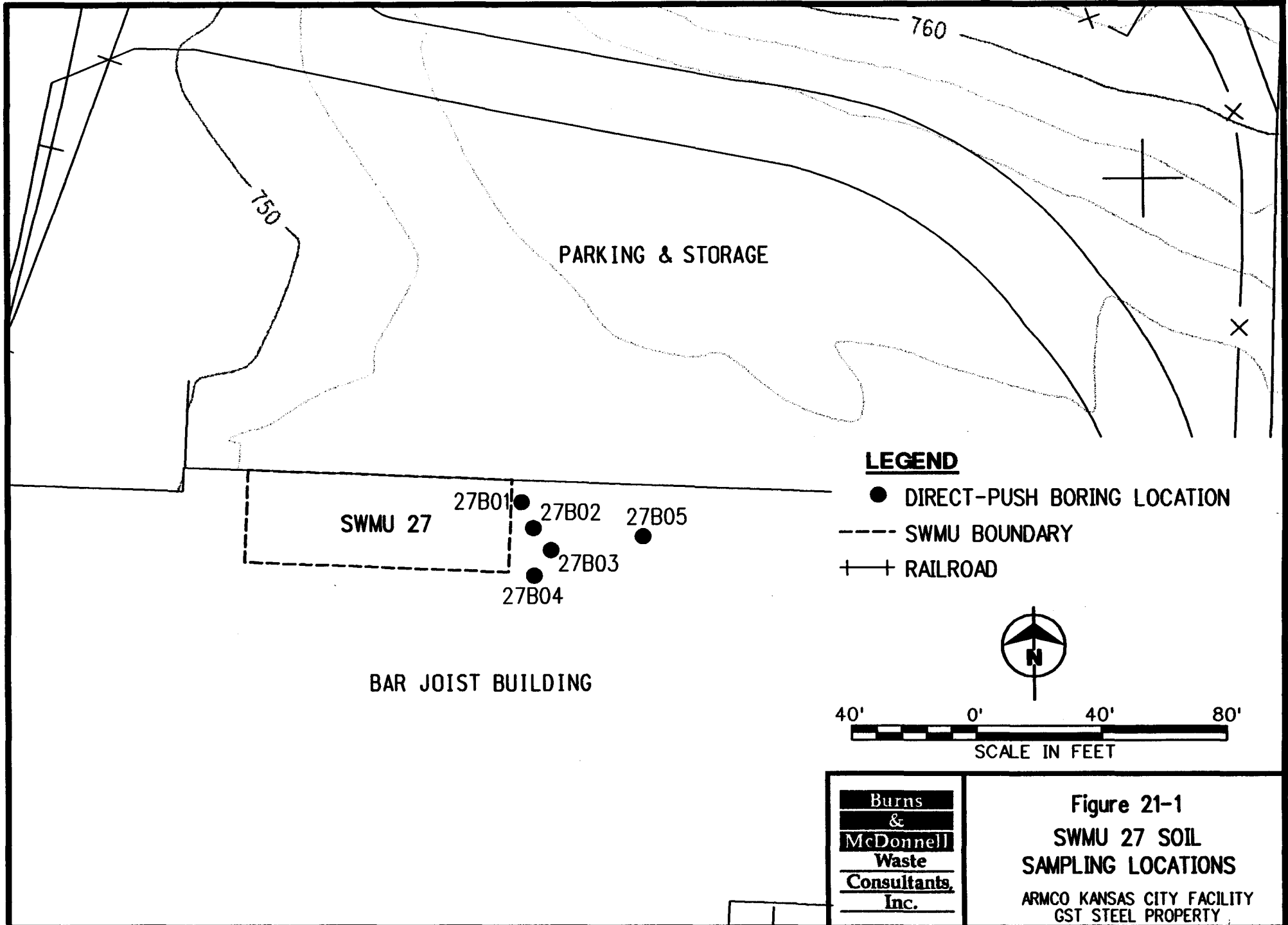
D = Sample was diluted for analysis.

DAF = Dilution Attenuation Factor

ft = feet

J\* = Qualified as estimated by BMWCI in the QC evaluation.

SSL = Soil Screening Level



## METALS SOIL DETECTIONS ABOVE SSLs

SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (mg/Kg)		SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (mg/Kg)	
CADMIUM (SSL=8 mg/Kg)				LEAD (SSL=400 mg/Kg)			
27B03/DP1	1-3	19.4	J*	27B03/DP1	1-3	526	J*
27B03/DP2	3-5	17.5	J*	27B03/DP2	3-5	547	J*
27B04/DP1	0.5-2	8.06	J*	27B04/DP2	2-3	456	D
27B04/DP2	2-3	13.5	J*	27B04/DP3D	3-4	441	D
27B04/DP3	3-4	12.1	J*	27B05/DP1	0.5-1	521	D
27B04/DP3D	3-4	12.9	J*	27B05/DP2	1-2	1,460	D
27B04/DP4	4-5	11.7	J*				
27B05/DP1	0.5-1	22.2	DJ*				
27B05/DP2	1-2	63	DJ*				

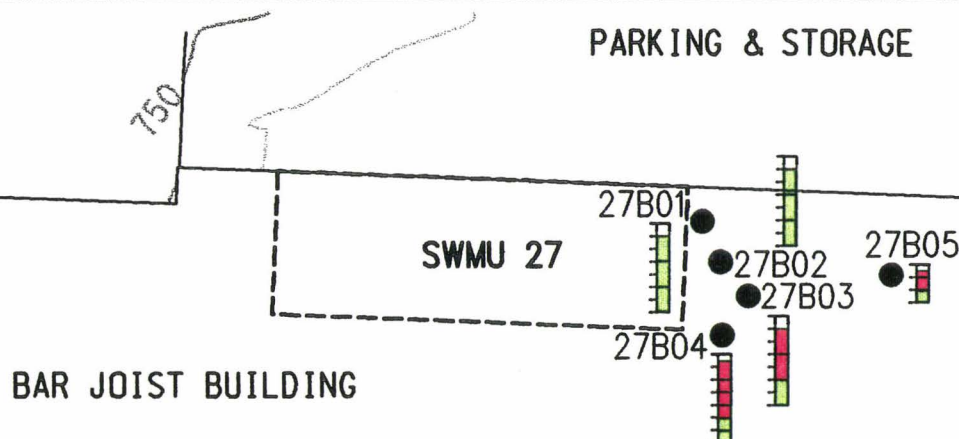
## QUALIFIER NOTES:

D - DILUTED SAMPLE

J\* - QUALIFIED AS ESTIMATED DURING QC EVALUATION

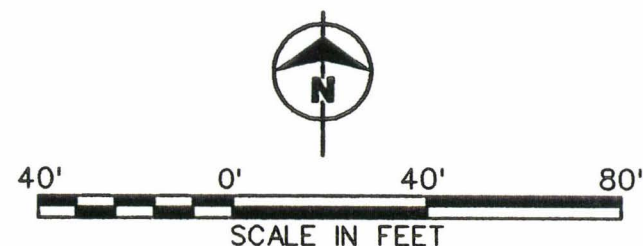
## LEGEND

- DIRECT-PUSH BORING LOCATION
- █ LEAD AND/OR CADMIUM RESULT (mg/Kg) ABOVE SSLs (SEE INSET TABLE)
- █ LEAD AND CADMIUM RESULTS (mg/Kg) BELOW SSLs
- NO SAMPLE WAS COLLECTED AT THIS DEPTH INTERVAL
- ▤ SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.
- SWMU BOUNDARY



## NOTES:

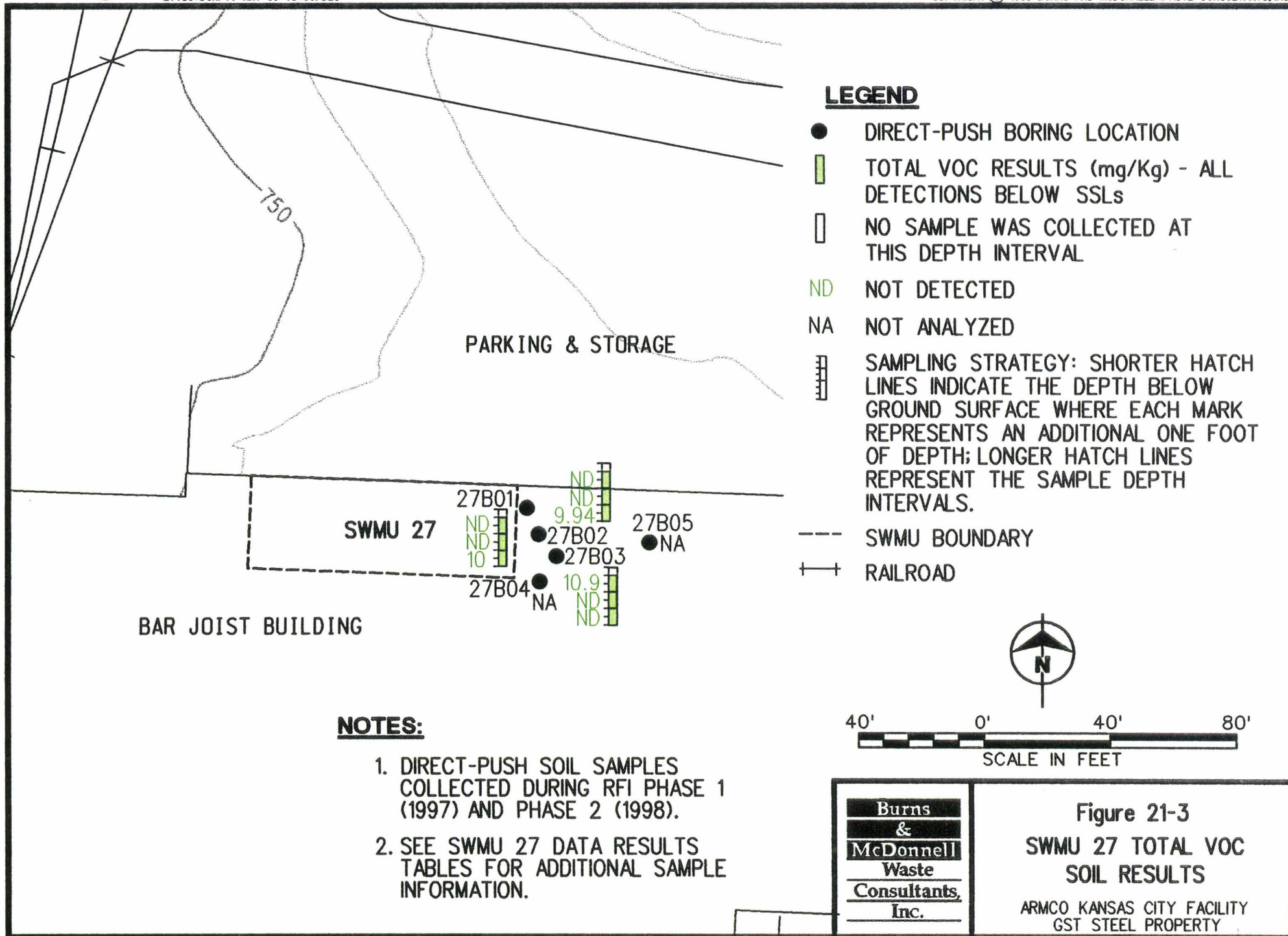
1. DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997) AND PHASE 2 (1998).
2. SEE SWMU 27 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.

Figure 21-2  
SWMU 27 LEAD AND  
CADMIUM SOIL RESULTS

ARMCO KANSAS CITY FACILITY  
GST STEEL PROPERTY



**SWMU 33**  
**NAIL MILL DEGREASING AREA**  
**(ARMCO PROPERTY)**



## **22.0 SWMU 33 – NAIL MILL DEGREASING AREA**

### **22.1 SWMU BACKGROUND**

#### **22.1.1 Description of SWMU**

The Nail Mill Degreasing Area (SWMU 33), located on Armco property (see Figure 1-2), was used for the removal of residue during the production of nails. The degreasing operation was located in the northwest portion of the Nail Mill. The presence of chlorinated VOCs in the surrounding area was discovered and reported in 1991 while Armco was preparing for the closure and conversion of the mill into a warehouse. The nail mill was subsequently demolished and a wood block floor contaminated with TCE was removed and properly disposed. The area currently consists of rubble over the concrete floor of the former building. The defined SWMU 33 area is approximately 2.5 acres in size.

During preparation for the closure of the nail mill, Remcor collected samples of the wood block floor, concrete floor, and soil from beneath the floor in June 1990. All samples were analyzed for VOCs. TCE, 1,1,1-TCA, PCE, 1,1-DCE, and benzene were detected in the samples (Remcor, 1990a).

In July 1991, Terracon Environmental conducted a Phase I and Phase II soil vapor survey of the area for TCE, 1,1,1-TCA, and total volatile organics. Terracon Environmental concluded that degreasing materials remain sorbed onto the shallower soils underlying the degreaser area and that a groundwater plume of VOCs was present in the area (Terracon Environmental, 1991). Terracon Environmental conducted a Phase II Investigation in September 1991 and collected soil and groundwater samples for VOC analysis (Terracon Environmental, 1991a). TCE, 1,2-DCE, 1,1,1-TCA, and chloroform were detected in soil samples. In addition, TCE and 1,2-DCE were detected in groundwater samples. Terracon Environmental concluded that TCE was present in soil near the degreaser location and decreased with depth and distance from the degreaser. Terracon Environmental also concluded that existing data were too limited to provide precise delineation of groundwater contamination. Four monitoring wells were installed during the



Phase II Investigation. Monitoring Well MW1 was located northeast of the previous degreaser location but was destroyed during demolition activities completed in that vicinity. Wells MW2 through MW4 (now labeled 33MW2 through 33MW4) still exist at the SWMU.

Based on the types of materials handled at SWMU 33 and previous sampling and analysis activities completed by Remcor and Terracon Environmental, the primary constituents of potential concern were VOCs associated with solvents.

Due to the close proximity of SWMU 17 to the east of SWMU 33 and the related nature of groundwater contamination in the area, SWMU 17 groundwater information is presented in this chapter.

#### **22.1.2 Release Potential**

Available information indicates solvents used at this SWMU may have been released to the underlying soils and groundwater. Because SWMU 33 is no longer active, and all associated structures have been demolished, the potential does not exist for future releases from this SWMU. The original concrete floor slabs remain in place but are now covered, at least partially, by rock and gravel associated with the demolition of the Nail Mill. The primary release potential for SWMU 33 was to the surrounding subsurface soil and groundwater.

### **22.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of subsurface soil and groundwater samples. Table 22-1 presents the investigation activities performed at SWMU 33. Figure 22-1 presents the soil and groundwater sampling locations.

#### **22.2.1 RFI Phase 1**

Subsurface soil samples were collected from 17 direct-push borings (Borings 33B01 through 33B10, and 33B13 through 33B19) and from one monitoring well borehole (33MW2S). Two to

four subsurface soil samples were collected from each boring at depth intervals up to 20 feet bgs. All subsurface samples were analyzed for VOCs.

Groundwater samples were collected from 47 direct-push borings (Borings 33B03 through 33B17, 33B19 through 33B47, 33B22A, 33B51, and 33MW6D). A large number of borings were advanced in order to assist in characterization and delineation of VOCs for the purposes of monitoring well placement. Samples were collected from the upper 10 feet of the water table and analyzed using a field GC for chlorinated VOCs and/or BTEX. Seven of the groundwater samples were sent to the analytical laboratory for confirmation of results. Six of the groundwater samples sent to the analytical laboratory were analyzed for VOCs, and three were analyzed for TPH and SVOCs.

At SWMU 17, groundwater samples were collected from four direct-push borings (Borings 17B04A, 17B06, 17B08, and 17B09 due to signs of contamination (sheen observed on the water table and organic odors) encountered in the groundwater at Boring 17B04. These groundwater samples were analyzed for VOCs, SVOCs, and TPH. Due to their proximity to the SWMU 33 area, these samples are presented with the SWMU 33 groundwater data.

Nine monitoring wells were installed at SWMU 33 (Wells 33MW2S, 33MW4S, 33MW5S/5D, 33MW6D, 33MW7S/7D, 33MW8S, 33MW9S) during RFI Phase 1. Wells were typically completed in two well clusters, with one well screened in the shallow unconfined saturated zone (approximately 10 to 20 feet bgs) and one screened just above bedrock in the semi-confined deep saturated zone (approximately 60 to 70 feet bgs). These shallow and deep wells are identified with an "S" or "D," respectively, to identify their general screen location. In addition to groundwater samples collected from the newly installed wells, groundwater was collected from three previously existing wells (Wells 33MW2, 33MW3, and 33MW4). All of the groundwater samples were analyzed for VOCs. In addition, the groundwater sample collected from Well 33MW5S was analyzed for SVOCs and TPH.

### **22.2.2 RFI Phase 2**

Three direct-push soil borings (Borings 33B29A, 33B30A, and 33B32A) were advanced, and four samples were collected from each boring in four foot intervals up to sixteen (16) feet bgs. Samples were sent to the analytical laboratory and analyzed for VOCs. Subsurface soil samples were also collected from direct-push Boring 33B56 and Monitoring Well Borehole 33MW5I. Two samples were collected from each boring at depths up to 17 feet bgs. The samples were analyzed for VOCs. In addition, the samples from Boring 33B56 were analyzed for SVOCs.

Groundwater was collected from direct-push Borings 33B52 through 33B55 and Boring 17B10. Groundwater samples were analyzed in the field for VOCs, and three samples (33B54/DW1, 33B55/DW1, and 17B10/DW1) were sent to the laboratory for confirmatory analysis of VOCs.

Eleven additional monitoring wells (33MW10S/10D, 33MW11S/11D, 33MW12S/12D, 33MW13S/13D, 33MW14S/14D, and 33MW5I) were installed in the SWMU 33 area during RFI Phase 2. Wells were typically completed in two well clusters, with one well screened in the shallow unconfined saturated zone and the second screened just above bedrock in the deep semi-confined saturated zone. These shallow and deep wells are identified with an "S" or "D," respectively, to identify their general screen location. Monitoring wells labeled with an "I," represent intermediate depth monitoring wells that are screened directly over the semi-confining layer of the shallow saturated zone. Groundwater was collected from all of the monitoring wells in the SWMU 33 area during RFI Phase 2 and analyzed for VOCs and natural attenuation parameters (see Appendix T). Groundwater samples from Wells 33MW5S/5I/5D, 33MW11S/11D, 33MW12S/12D, and 33MW13S/13D were also analyzed for pH and RCRA metals to aid in characterization of dissolved metals in groundwater at SWMU 13, and these results are presented with SWMU 13 (Chapter 15.0).

This area is underlain by approximately 10 feet of gravel to boulder size slag and refractory brick fragments in a silty to sandy clay matrix. There are extensive areas of intact concrete floor remaining from demolished former mill buildings in this area. The fill layer generally thins closer to the Blue River and is thicker in buried creek channels and in buried basements below the former mill building footprints. Below the fill material is silty clay typical of Blue River

alluvial valley sediments. The silty clay alluvium with local, discontinuous interbeds of fine sandy clay is approximately 50 feet thick. Below the silty clay is approximately 5 feet of clayey to sandy gravel directly overlying the Pennsylvanian shale bedrock. There are two saturated zones within the unconsolidated materials. There is a shallow, unconfined saturated zone with a static groundwater surface approximately 5 to 15 feet bgs and a deeper, semi-confined saturated zone with a groundwater surface approximately 20 to 30 feet bgs.

## **22.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Tables 22-2 and 22-3 present the analytical results for the subsurface soil samples.

### **22.3.1 VOCs**

Figure 22-2 shows the subsurface soil Total VOC results. Fifty-eight subsurface soil samples were collected from 23 borings at SWMU 33 and analyzed for VOCs. Total VOC detections ranged from 2.01 to 24,423  $\mu\text{g/Kg}$ . Total VOC concentrations greater than 1,000  $\mu\text{g/Kg}$  (15 samples) were located nearest the former degreaser location in the samples collected from Borings 33B01, 33B02, 33B05, 33B14, 33B15, and 33MW2S. Chlorinated VOCs (1,1,1-TCA, 1,1,2-TCA, 1,1-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, methylene chloride, and vinyl chloride) were typically detected in this area. This information supports an earlier conclusion that degreasing materials remain sorbed onto soils underlying the degreaser area. Nonchlorinated VOCs (BTEX, 2-hexanone, acetone, and carbon disulfide) were also detected, but these detections were more sporadic across the sampling area.

The 20 DAF SSLs for 1,1-DCE (60  $\mu\text{g/Kg}$ ), cis-1,2-DCE (400  $\mu\text{g/Kg}$ ), TCE (60  $\mu\text{g/Kg}$ ), and vinyl chloride (10  $\mu\text{g/Kg}$ ) were exceeded for one sample, 10 samples, 26 samples, and three samples, respectively. The highest detections of 1,1-DCE (61.9  $\mu\text{g/Kg}$ ), cis-1,2-DCE (6,180  $\mu\text{g/Kg}$ ), TCE (19,800  $\mu\text{g/Kg}$ ), and vinyl chloride (195  $\mu\text{g/Kg}$ ) were noted in samples from Borings 33B01 (5 to 9 feet bgs) and 33MW2S (1 to 7.5 feet bgs) close to the former degreaser location. The highest detections of chlorinated VOCs were typically encountered from 5 to 10 feet bgs; however, exceedences were noted as shallow as 1 to 5 feet bgs and as deep as 19 to 20 feet bgs. Table 22-7 presents the soil samples with 20 DAF SSL exceedences.

Total VOC concentrations decreased radially outward from the former degreaser location. The horizontal extent of VOCs in soil was well defined by borings south (Borings 33B08, 33B09, 33B13, 33B17, and 33B18), west (Boring 33B07), and east (Boring 33MW5I) of the former degreaser location. The northern extent of VOCs in soils was less clearly defined by Boring 33B32A since a sample collected from Boring 33B56 (north of Boring 33B32A) had a vinyl chloride detection that exceeded the 20 DAF SSL. Based upon the drilling logs (Appendix B), it appears that the sample from Boring 33B56 was collected below the water table and may represent VOCs present in the surrounding groundwater rather than subsurface soils. VOCs were encountered at all depth intervals (up to 20 feet bgs) at sampling locations in the immediate vicinity of the former degreaser, and the vertical extent of VOCs was pursued until the groundwater table was reached. Moving radially outward from the former degreaser, VOCs were generally limited to the soil depths below 8 feet bgs.

In some borings, increases in soil VOC concentrations tended to occur in the deeper samples collected immediately above (approximately 16 to 20 feet bgs) the shallow groundwater table. These increased concentrations may be attributed to the pressure of the saturated capillary fringe of the groundwater table that inhibits further migration of constituents to the groundwater.

#### **22.3.2 SVOCs**

Due to odors encountered during direct-push boring installation, two subsurface soil samples were collected from Boring 33B56 and analyzed for SVOCs. 2-Methylnaphthalene (15.4 D mg/Kg) was detected in the sample collected from 13-15 feet bgs. A 20 DAF SSL has not been established for this compound.

### **22.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Tables 22-4 through 22-5 present the analytical results for groundwater samples collected in the SWMU 33 area. Figures 22-3 through 22-6 show the analytical results for groundwater samples. During the RFI, groundwater samples were collected throughout the SWMU 33 area and analyzed for VOCs. Selected samples were also analyzed for SVOCs and TPH. TPH results are presented in Appendix U. On-site analysis of VOCs using a field GC was performed as a

screening tool for plume definition to aid in the monitoring well placement. On-site GC results are presented in Appendix R. Natural attenuation parameter results are provided in Appendix T.

#### **22.4.1 VOCs**

##### **22.4.1.1 RFI Phase 1**

During RFI Phase 1, groundwater samples were collected from 13 direct-push borings and 12 monitoring wells and analyzed for VOCs. Six of the monitoring wells (Wells 33MW2S, 33MW4S, 33MW5S, 33MW7S, 33MW8S, and 33MW9S) were screened in the shallow unconfined saturated zone, and five of the monitoring wells (Wells 33MW3, 33MW4, 33MW5D, 33MW6D, and 33MW7D) were screened in the deep semi-confined saturated zone. Well 33MW2 is an intermediate depth monitoring well that was screened directly over the semi-confining layer of the shallow saturated zone.

Results for the RFI Phase 1 groundwater samples collected from the shallow unconfined saturated zone are presented on Figure 22-3. Total VOC detections ranged from 36.5 to 141,276 µg/L, and chlorinated VOCs were the predominant fraction detected. The groundwater screening MCLs were exceeded for 1,1,2-TCA (two samples), 1,1-DCE (four samples), 1,2-DCA (one sample), cis-1,2-DCE (seven samples), trans-1,2-DCE (one sample), PCE (one sample), TCE (eight samples), and vinyl chloride (nine samples). Table 22-8 presents the groundwater results that exceeded MCLs. Total VOC results for samples collected from Boring 17B08 (22,364 µg/L) and Monitoring Well 33MW2S (141,276 µg/L) were at least an order of magnitude greater than other VOC samples. In both samples, cis-1,2-DCE and TCE comprised the majority of the total concentrations. Intermediate depth 33MW2 (located adjacent to 33MW2S) contained a total VOC concentration of 2,878.1 µg/L, which consisted primarily of cis-1,2-DCE and vinyl chloride. Monitoring Wells 33MW2S and 33MW2 are located in the immediate vicinity of the former degreaser, and Boring 17B08 is located adjacent to the former wire mill rinsewater neutralization tank (SWMU 17). In general, VOC concentrations in the groundwater decreased in the outermost wells at SWMU 33, and no MCL exceedences were noted in the shallow saturated zone samples collected from the westernmost (33MW4S) and southernmost (33MW7S) wells.



Results for the RFI Phase 1 groundwater samples collected from the deep semi-confined saturated zone are presented on Figure 22-4. VOCs were not detected in groundwater samples collected from four of the five monitoring wells. The sample collected from Monitoring Well 33MW3 had detections of cis-1,2-DCE (21.9 µg/L), TCE (32.1 µg/L), and vinyl chloride (19.1 µg/L); however, only the TCE and vinyl chloride detections exceeded MCLs (5 and 2 µg/L, respectively). Monitoring Well 33MW3 is located in the immediate vicinity of the former degreaser, and the extent of VOCs in the deep semi-confined saturated zone were defined by wells in the surrounding area (33MW4, 33MWSD, 33MW6D, and 33MW7D).

#### **22.4.1.2 RFI Phase 2**

During RFI Phase 2, groundwater samples were collected from three direct-push borings and 23 monitoring wells and analyzed for VOCs. Five monitoring well clusters (33MW10S/10D, 33MW11S/11D, 33MW12S/12D, 33MW13S/13D, and 33MW14S/14D) were installed during RFI Phase 2. The two well clusters contained one well screened in the shallow unconfined saturated zone and a second well screened in the deep semi-confined saturated zone. Well 33MW5I was installed during RFI Phase 2 as an intermediate depth monitoring well that was screened directly over the semi-confining layer of the shallow saturated zone.

Figure 22-5 presents the results for the RFI Phase 2 groundwater samples collected from the shallow unconfined saturated zone and also depicts isoconcentration contours. To aid in characterization of the VOC plume, Phase 1 direct-push groundwater samples are also shown on this figure with the Phase 2 direct-push and monitoring well data.

Total VOC detections ranged from 7.15 to 127,847 µg/L, and chlorinated VOCs were the predominant fraction detected. The groundwater screening MCLs were exceeded for benzene (one sample), 1,1,2-TCA (one sample), 1,1-DCE (two samples), 1,2-DCA (one sample), cis-1,2-DCE (four samples), methylene chloride (one sample), PCE (one sample), TCE (five samples), and vinyl chloride (four samples). VOC results for samples collected from Monitoring Well 33MW2S (127,847 µg/L) which is located in the immediate vicinity of the former degreaser were at least two orders of magnitude greater than other VOC samples. Total VOC

concentrations in surrounding monitoring wells to the west (33MW8S) and east (33MW5S) of this location were significantly lower (71.67 and 431.8 µg/L respectively). VOC concentrations in intermediate depth monitoring wells were 9042.4 µg/L (33MW2) and 1990.58 µg/L (33MW5I). As shown on the isoconcentration contours, a chlorinated VOC plume is present in the shallow unconfined saturated zone throughout the SWMU 33 vicinity. The extent of VOCs in the shallow unconfined saturated zone was well defined by samples collected from wells around the perimeter of the area that had no detected VOCs (Wells 33MW7S, 33MW10S, 33MW11S, 33MW12S, 33MW13S, and 33MW14S), or low concentrations of detected VOCs (33MW9S).

Figure 22-6 presents the results for the RFI Phase 2 groundwater samples collected from the deep semi-confined saturated zone and also depicts isoconcentration contours. VOCs were not detected in samples collected from seven of the 10 monitoring wells. Chlorinated VOCs were the only detected VOCs. 1,1-DCE (2.42 J µg/L), cis-1,2-DCE (326 D µg/L), TCE (35.1 µg/L), and vinyl chloride (148 µg/L) were detected in the sample collected from Monitoring Well 33MW3, located nearest the former degreaser location. Cis-1,2-DCE, TCE, and vinyl chloride exceeded the groundwater screening MCLs. Cis-1,2-DCE (2.92 J µg/L) was detected below the groundwater screening MCL in the sample collected from Monitoring Well 33MW11D, which is located along the Blue River in the northeast portion of the SWMU 33 area. 1,1-DCA (4.32 J µg/L) 1,1-DCE (2.2 J µg/L), cis-1,2-DCE (74.4 µg/L), and vinyl chloride (9.05 µg/L) were detected in Monitoring Well 33MW10D which is located along the Blue River in the northwest portion of the SWMU 33 area. Since the sample from Well 33MW10D contained detections of cis-1,2-DCE and vinyl chloride that exceeded MCLs, a second sample was collected from this well in the fall of 1998 and the results confirmed the initial analysis. The extent of VOCs in the deep semi-confined saturated zone was well defined by wells in the perimeter of the SWMU 33 area to the east, south, and west. The extent of VOCs in the deep semi-confined saturated zone was less clearly defined to the north due to chlorinated VOC detections in Well 33MW10D.

### **22.4.1.3 VOC Summary**

As previously described and shown on Figures 22-5 and 22-6, chlorinated VOCs in groundwater are centrally located around the SWMU 33 former degreasing pit (Monitoring Wells 33MW2S, 33MW2, 33MW3), and decrease radially outward from this location. VOCs detected were primarily TCE, which was most likely a source product, and related degradation products cis-1,2-DCE and vinyl chloride. The degradation of chlorinated VOCs is described in greater detail in Chapter 25.0 (Contaminant Fate and Transport Potential).

VOCs have migrated at Monitoring Wells 33MW2S, 33MW2, and 33MW3 from the shallow unconfined saturated zone to the deep semi-confined saturated zone. This hydraulic connection between the two aquifers is supported by the results of the pump test conducted at this location (see Section 2.6.2.2). The horizontal extent of VOCs in the groundwater is defined by perimeter monitoring wells. The source detections of VOCs in deep Well 33MW10D is unknown and it is uncertain if these detections are part of the larger plume of VOC detections centered around Wells 33MW2S, 33MW2, and 33MW3.

### **22.4.2 SVOCs**

During RFI Phase 1, groundwater samples were collected from seven direct-push borings (Borings 33B45 through 33B47, 17B04A, 17B06, 17B08, and 17B09) and Monitoring Well 33MW5S in the shallow unconfined saturated zone (See Subsection 2.6.2) and analyzed for SVOCs. SVOCs were not detected in the samples collected from SWMU 17. SVOCs were also not detected in the groundwater samples collected from Borings 33B45 and 33B46; however, the results for these samples were rejected due to quality control samples that indicated a potential low bias in the analytical results. 4-Chloroaniline (4.1 J  $\mu\text{g/L}$ ), 4-methylphenol (2.8 J  $\mu\text{g/L}$ ), and naphthalene (2.9 J  $\mu\text{g/L}$ ) were each detected in the sample collected from Boring 33B47. No MCLs have been established for these compounds. However, SVOCs were not detected in the groundwater sample collected from Well 33MW5S which was installed at the approximate location and depth of Boring 33B47. Therefore, the nature and extent of SVOCs in groundwater was adequately characterized at SWMU 33.

## 22.5 FATE AND TRANSPORT POTENTIAL

Potential migration pathways for SWMU 33, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and air pathways (volatilization and airborne dust).

The nature and extent of contamination at SWMU 33 was assessed through the collection of subsurface soil and groundwater samples. VOC concentrations in soil exceeded 20 DAF SSLs (based on soil migration to groundwater) at depths to 20 feet bgs (approximate deepest elevation 727 feet above MSL). VOCs were detected in groundwater throughout SWMU 33 and its surrounding area. Therefore, soil transfer to groundwater and groundwater transport have and/or are occurring at SWMU 33.

VOCs in groundwater were detected in both the shallow unconfined saturated zone and the deep semi-confined saturated zone. SWMU 33 is located adjacent to the channelized Blue River on its north side. Groundwater flow direction in the shallow unconfined saturated zone is to the northeast. However, it does not appear to be hydraulically connected to the Blue River due to the lack of groundwater infiltrating through seep holes into the channel. Groundwater flow direction in the deep semi-confined saturated zone typically forms a trough in the center of the SWMU area. The typical elevation of the deep semi-confined saturated zone is approximately the same as the low-flow channel elevation in the channelized Blue River. Groundwater flow direction for the SWMU 33 area was described in greater detail in Chapter 2.0 (see Figures 2-18 through 2-25). Chapter 2.0 also provided a summary of hydraulic conductivities for the soil matrices at SWMU 33. VOCs, given their chemical and physical characteristics, are expected to degrade and/or volatilize as they migrate in the direction of groundwater flow. Degradation of VOCs is occurring in the groundwater based on the detection of TCE daughter products (e.g., cis-1,2-DCE and vinyl chloride). Subsurface transport modeling of VOCs in groundwater was attempted for the SWMU 33 area. This is described in more detail in Section 25.3 of the Report.

Surface cover material at SWMU 33 is primarily slag fill. Storm water runs toward either storm drains east of the SWMU or storm drain catch basins west of the SWMU. Storm sewers

throughout the area discharge to the Blue River. Surface soil particulate (dust) could become airborne. VOCs in the subsurface may partition to the gas phase and may migrate to the air pathway. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, volatilization to air, and airborne dust transport are potential routes for constituent migration at SWMU 33.

## **22.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 33.

### **22.6.1 Human Health Evaluation**

VOCs were identified as COPCs in subsurface soil. VOCs, SVOCs, and metals were identified as COPCs in groundwater. A human health risk assessment was conducted for SWMU 33 to evaluate potential health risks to existing and/or possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the chemicals of concern detected in soil or groundwater at SWMU 33. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization are presented in Chapter 5.0 of Appendix X.

### **22.6.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 33. Therefore, an ecological risk evaluation was not conducted for SWMU 33.

## 22.7 SUMMARY

SWMU 33, located in the western portion of the Facility, was a degreasing operation for the removal of residue during the production of nails. The defined SWMU 33 area is approximately 2.5 acres in size. The area investigated for SWMU 33 groundwater included the entire area north of the Wire Mill Building to the Blue River, and encompassed the SWMUs 13 and 17 areas. Subsurface soil and groundwater samples were collected at SWMU 33.

Figure 22-2 presents the subsurface soil Total VOC results. Fifty-eight subsurface soil samples were collected from 23 borings at SWMU 33 and analyzed for VOCs. Total VOC detections ranged from 2.01 to 24,423  $\mu\text{g/Kg}$ . Total VOC concentrations greater than 1,000  $\mu\text{g/Kg}$  (15 samples) were located nearest the former degreaser location, and chlorinated VOCs were the predominant fraction detected. Total VOC concentrations decreased around the perimeter of the SWMU area. The horizontal extent of VOCs in soil was well defined by borings south, west, and east of the former degreaser location, but was less clearly defined to the north. VOCs were encountered at all depth intervals (up to 20 feet bgs) at sampling locations in the immediate vicinity of the former degreaser, and the vertical extent of VOCs was pursued until the groundwater table was reached. In areas surrounding the former degreaser location, VOCs were generally limited to the soil depths below 8 feet bgs.

Two subsurface soil samples were collected from Boring 33B56 and analyzed for SVOCs. 2-Methylnaphthalene (15.4 D mg/Kg) was detected in the sample collected from 13-15 feet bgs. A 20 DAF SSL has not been established for this compound. No other SVOCs were detected in soil.

Groundwater VOC samples were collected throughout the SWMU 33 area from direct-push borings (approximately 55 samples) and 23 monitoring wells. As shown on Figures 22-5 and 22-6, chlorinated VOCs in groundwater are centrally located around the SWMU 33 former degreasing pit (Monitoring Wells 33MW2S, 33MW2, 33MW3), and decrease radially outward from this location. VOCs detected were primarily TCE, which was most likely a source product, and related degradation products cis-1,2-DCE and vinyl chloride. Total VOC results for samples collected from shallow Well 33MW2S (127,847  $\mu\text{g/L}$ ), intermediate Well 33MW2 (9,042.4



µg/L), and deep Well 33MW3 (511.52 µg/L) were significantly greater than other VOC samples. Total VOC concentrations in monitoring wells (33MW8S, 33MW7S/7D, and 33MW5S/5I/5D) peripheral to the former degreaser location were significantly lower or non-detect.

VOCs have migrated at Monitoring Wells 33MW2S, 33MW2, and 33MW3 from the shallow unconfined saturated zone to the deep semi-confined saturated zone. This hydraulic connection between the two saturated zones is supported by the results of the pump test conducted at this location (see Section 2.6.2.2). The horizontal extent of VOCs in the upper unconfined and lower semi-confined saturated zones were defined by samples collected from the perimeter of the SWMU 33 area. The extent of VOCs in the lower semi-confined saturated zone was less clearly defined to the north due to chlorinated VOC detections in excess of MCLs in the sample from Well 33MW10D. The source of VOC detections in deep Well 33MW10D is unknown, and it is unclear if these detections are part of the larger plume of VOC detections centered around the former degreaser.

Eight groundwater samples were collected from the upper unconfined saturated zone and analyzed for SVOCs. The SVOCs 4-chloroaniline, 4-methylphenol, and naphthalene were detected at low concentrations in the sample collected from Boring 33B47 (no MCLs exist for these compounds). However, SVOCs were not detected in the sample collected from Well 33MW5S which was installed at the approximate location and depth of Boring 33B47. Therefore, the nature and extent of SVOCs in groundwater was adequately characterized at SWMU 33.

Potential migration pathways at SWMU 33 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, volatilization to air, and airborne dust migration. Subsurface soil detections of VOCs exceeded 20 DAF SSLs (based on soil migration to groundwater) and VOCs are located in groundwater throughout the SWMU 33 area in both the shallow unconfined saturated zone and the deep semi-confined saturated zone. Therefore, soil transfer to groundwater and groundwater transport have and/or are occurring at SWMU 33. VOCs, given their chemical and physical characteristics, are expected to degrade and/or volatilize as they migrate in the direction of groundwater flow. Degradation of

VOCs is occurring in the groundwater based on the detection of TCE daughter products (e.g., cis-1,2-DCE and vinyl chloride). Contaminant transport modeling was attempted for VOCs in groundwater at SWMU 33, and is summarized in detail in Section 25.3 of the Report.

Storm water runs toward either storm drains east of the SWMU or storm drain catch basins west of the SWMU. Storm sewers throughout the area discharge to the Blue River. Surface soil particulate (dust) could become airborne. VOCs in the subsurface may partition to the gas phase and may migrate to the air pathway. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, volatilization to air, and airborne dust transport are potential routes for constituent migration at SWMU 33.

A risk evaluation was conducted for SWMU 33. For the human health evaluation, VOCs, SVOCs, and metals were identified as COPCs in groundwater (includes groundwater data from SWMU 17) and VOCs were identified as COPCs in subsurface soil. Therefore, a HHRA was conducted to evaluate potential health risks to existing and/or possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil and groundwater at SWMU 33 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 33.

\* \* \* \* \*

**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
DIRECT-PUSH SUBSURFACE SOIL SAMPLES															
33B01	DP1	1 - 5	03/31/1997	1			X							Rinsate	D97-3879-1
	DP2	5 - 9	03/31/1997	1			X								D97-3879-2
	DP3	9 - 13	03/31/1997	1			X								D97-3879-3
	DP3R		03/31/1997	1			X								D97-3879-4
33B02	DP1	1 - 5	03/31/1997	1			X								D97-3879-5
	DP2	5 - 9	03/31/1997	1			X								D97-3879-6
	DP3	9 - 13	03/31/1997	1			X								D97-3879-7
33B03	DP1	3.2 - 4.2	04/08/1997	1			X								D97-4264-4
	DP2	7 - 8	04/08/1997	1			X								D97-4264-5
33B04	DP1	1.7 - 2.4	04/07/1997	1			X							Field Duplicate	D97-4256-1
	DP1D	1.7 - 2.4	04/07/1997	1			X								D97-4256-2
	DP2	8 - 9	04/07/1997	1			X								D97-4256-3
33B05	DP1	2.5 - 3.5	04/07/1997	1			X								D97-4256-5
	DP2	7 - 8	04/07/1997	1			X								D97-4256-6
33B06	DP1	1.6 - 2.6	04/07/1997	1			X								D97-4256-7
	DP2	6 - 7	04/07/1997	1			X								D97-4256-8
	DP3	9 - 10	04/07/1997	1			X								D97-4256-9
33B07	DP1	2.5 - 3.5	04/07/1997	1			X								D97-4256-10
	DP2	6.8 - 7.8	04/07/1997	1			X								D97-4256-11
33B08	DP1	1.5 - 2.5	04/07/1997	1			X							Field Duplicate	D97-4256-12
	DP2	6.5 - 7.5	04/07/1997	1			X								D97-4256-13
	DP2D	6.5 - 7.5	04/07/1997	1			X								D97-4256-14
33B09	DP1	0.8 - 1.8	04/07/1997	1			X							Rinsate	D97-4256-15
	DP1R		04/07/1997	1			X								D97-4256-17
	DP2	6 - 7	04/07/1997	1			X								D97-4256-16
33B10	DP1	1 - 2	04/08/1997	1			X								D97-4264-1
	DP2	7.5 - 8.5	04/08/1997	1			X								D97-4264-2
33B13	DP1	4 - 5	04/08/1997	1			X								D97-4264-10
	DP2	8 - 9	04/08/1997	1			X								D97-4264-11
33B14	DP1	2.1 - 3.1	04/08/1997	1			X								D97-4264-12
	DP2	5 - 6	04/08/1997	1			X								D97-4264-13
33B15	DP1	1.5 - 2.5	04/09/1997	1			X								D97-4344-1
	DP2	6.5 - 7.5	04/09/1997	1			X								D97-4344-2
	DP3	9.5 - 10.5	04/09/1997	1			X								D97-4344-3
33B16	DP1	1 - 2	04/09/1997	1			X								D97-4344-4
	DP2	6 - 7	04/09/1997	1			X								D97-4344-5

**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
33B17	DP1	3 - 4	04/09/1997	1			X								D97-4344-6
	DP2	5.5 - 6.5	04/09/1997	1			X								D97-4344-7
33B18	DP1	2.5 - 5	04/09/1997	1			X							Matrix Spike Matrix Spike Duplicate	D97-4344-8
	DP1MS	2.5 - 5	04/09/1997	1			X								D97-4344-9
	DP1MSD	2.5 - 5	04/09/1997	1			X								D97-4344-10
	DP2	5 - 6	04/09/1997	1			X								D97-4344-11
33B19	DP1	4 - 5	04/09/1997	1			X							Matrix Spike Matrix Spike Duplicate	D97-4344-13
	DP2	5.5 - 8	04/09/1997	1			X								D97-4344-14
	DP2MS	5.5 - 8	04/09/1997	1			X								D97-4344-15
	DP2MSD	5.5 - 8	04/09/1997	1			X								D97-4344-16
33B29A	DP1	0 - 4	06/04/1998	2			X							Matrix Spike Matrix Spike Duplicate	D98-4166-7
	DP2	4 - 8	06/04/1998	2			X								D98-4166-8
	DP2MS	4 - 8	06/04/1998	2			X								D98-4166-9
	DP2MSD	4 - 8	06/04/1998	2			X								D98-4166-10
	DP3	8 - 12	06/04/1998	2			X								D98-4166-11
	DP4	12 - 16	06/04/1998	2			X								D98-4166-12
33B30A	DP1	0 - 4	06/04/1998	2			X							Field Duplicate	D98-4166-2
	DP2	4 - 8	06/04/1998	2			X								D98-4166-3
	DP2D	4 - 8	06/04/1998	2			X								D98-4166-4
	DP3	8 - 12	06/04/1998	2			X								D98-4166-5
	DP4	12 - 16	06/04/1998	2			X								D98-4166-6
33B32A	DP1	0 - 4	06/02/1998	2			X							Field Duplicate	D98-4081-1
	DP2	4 - 8	06/02/1998	2			X								D98-4081-2
	DP3	8 - 12	06/02/1998	2			X								D98-4081-3
	DP3D	8 - 12	06/02/1998	2			X								D98-4081-4
	DP4	12 - 16	06/02/1998	2			X								D98-4081-5
	DP4R	06/02/1998	2				X							Rinsate	
<b>OTHER COLLECTED SUBSURFACE SOILS</b>															
33MW5I	SB1	8 - 10	06/16/1998	2			X								D98-4394-1
	SB2	11 - 12	06/16/1998	2			X								D98-4394-2
33B56	SB1	13 - 15	06/17/1998	2			X	X							D98-4412-1
	SB2	15 - 17	06/17/1998	2			X	X							D98-4412-2
<b>DIRECT-PUSH GROUNDWATER SAMPLES<sup>3</sup></b>															
33B03	DW1	16 - 18	04/08/1997	1	X										
33B04	DW1	13 - 15	04/07/1997	1	X										
33B05	DW1	17 - 19	04/07/1997	1	X										
33B06	DW1	24 - 26	04/07/1997	1	X										
33B07	DW1	24 - 26	04/07/1997	1	X										

**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
33B08	DW1	26 - 28	04/07/1997	1	X										
33B09	DW1	26 - 28	04/07/1997	1	X										
33B10	DW1	22 - 24	04/08/1997	1	X										
33B11	DW1	20 - 22	04/08/1997	1	X										
33B12	DW1	18 - 20	04/08/1997	1	X	X									
33B13	DW1	20 - 22	04/08/1997	1	X	X									
33B14	DW1	18 - 20	04/08/1997	1	X	X									
33B15	DW1	18 - 20	04/09/1997	1	X	X									
33B16	DW1	18 - 20	04/09/1997	1	X	X									
33B17	DW1	18 - 20	04/09/1997	1	X	X									
33B19	DW1	20 - 22	04/09/1997	1	X	X									
33B20	DW1	16 - 18	04/11/1997	1	X	X									
33B21	DW1	18 - 20	04/11/1997	1	X	X								Field Duplicate	
	DW1D	18 - 20	04/11/1997	1	X	X									
33B22A	DW1	25 - 25.5	04/18/1997	1	X		X							Field Duplicate	D97-4807-1
	DW1D	25 - 25.5	04/18/1997	1			X								D97-4807-2
33B23	DW1	18 - 20	04/11/1997	1	X	X								Matrix Spike Matrix Spike Duplicate	
	DW1MS	18 - 20	04/11/1997	1	X										
	DW1MSD	18 - 20	04/11/1997	1	X										
33B24	DW1	22 - 24	04/11/1997	1	X	X									
33B25	DW1	22 - 24	04/11/1997	1	X	X								Field Duplicate	
	DW1D	22 - 24	04/11/1997	1	X	X									
33B26	DW1	20 - 22	04/11/1997	1	X	X									
33B27	DW1	20 - 22	04/11/1997	1	X	X									
33B28	DW1	20 - 22	04/11/1997	1	X	X								Matrix Spike Matrix Spike Duplicate	
	DW1MS	20 - 22	04/11/1997	1	X										
	DW1MSD	20 - 22	04/11/1997	1	X										
33B29	DW1	18 - 20	04/11/1997	1	X	X									
33B30	DW1	18 - 20	04/14/1997	1	X										
33B31	DW1	18 - 20	04/14/1997	1	X										
33B32	DW1	18 - 20	04/14/1997	1	X	X									
33B33	DW1	18 - 20	04/14/1997	1	X	X									
33B34	DW1	16 - 18	04/14/1997	1	X										
33B35	DW1	18 - 20	04/14/1997	1	X										
33B36	DW1	18 - 20	04/14/1997	1	X										
33B37	DW1	21 - 23	04/15/1997	1	X										

**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
33B38	DW1	18 - 20	04/15/1997	1	X	X								Field Duplicate	
	DW1D	18 - 20	04/15/1997	1	X										
33B39	DW1	24 - 26	04/15/1997	1	X	X									
33B40	DW1	27 - 29	04/15/1997	1	X	X								Field Duplicate	
	DW1D	27 - 29	04/15/1997	1	X	X									
33B41	DW1	18 - 20	04/16/1997	1	X		X							Matrix Spike Matrix Spike Duplicate	D97-4731-3
	DW1MS	18 - 20	04/16/1997	1	X										
	DW1MSD	18 - 20	04/16/1997	1	X										
33B42	DW1	13 - 15	04/16/1997	1	X										
33B43	DW1	13 - 15	04/16/1997	1	X										
33B44	DW1	18 - 20	04/16/1997	1	X										
33B45	DW1	18 - 20	04/17/1997	1	X			X	X						D97-4731-6
33B46	DW1	18 - 20	04/17/1997	1	X		X	X	X						D97-4731-5
33B47	DW1	8 - 10	04/17/1997	1	X		X	X	X						D97-4731-4
33B48	DW1		04/18/1997	1										Refusal	
33B49	DW1		04/18/1997	1										Refusal	
33B50	DW1		04/18/1997	1										Refusal	
33B51	DW1	18 - 20	04/18/1997	1	X		X							Matrix Spike Matrix Spike Duplicate	D97-4807-3
	DW1MS	18 - 20	04/18/1997	1			X								D97-4807-4
	DW1MSD	18 - 20	04/18/1997	1			X								D97-4807-5
33MH1 <sup>4</sup>	DW1		04/16/1997	1	X										
33B52	DW1	13 - 17	05/14/1998	2	X	X									
33B53	DW1	13 - 17	05/14/1998	2	X	X									
33B54	DW1	13 - 17	05/14/1998	2	X	X	X								D98-3694-1
33B55	DW1	13 - 17	05/14/1998	2	X	X	X								D98-3694-2
	DW2	64 - 68	05/14/1998	2	X	X									
	DW3	33 - 37	05/14/1998	2	X	X									
33MW6D	DW1	12 - 20	04/17/1997	1	X		X								D97-4731-2
<b>CONTINUOUSLY SAMPLED SOIL MONITORING WELL SAMPLES</b>															
33MW2S	CS1	1 - 5	05/07/1997	1			X								D97-5623-2
	CS2	7 - 7.5	05/07/1997	1			X								D97-5623-3
	CS3	14 - 15	05/07/1997	1			X								D97-5623-4
	CS4	19 - 20	05/07/1997	1			X								D97-5623-5
33MW5D	CS1	12 - 13	04/15/1997	1									X		D97-5281-1
	CS2	32 - 33	04/15/1997	1									X		D97-5281-3
	CS3	42 - 43	04/15/1997	1									X		D97-5281-4

**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
33MW6D	CS1	38 - 39	04/17/1997	1									X		D97-5281-5
	CS2	54 - 56	04/17/1997	1									X		D97-5281-6
	CS3	63 - 65	04/17/1997	1									X		D97-5281-8
33MW7D	CS1	20 - 20.5	05/06/1997	1									X		D97-6623-4
	CS2	52 - 52.5	05/06/1997	1									X		D97-6623-5
<b>MONITORING WELL GROUNDWATER SAMPLES</b>															
MW2	GW1	NA	05/12/1997	1			X								D97-5825-11
	GW2	NA	07/17/1998	2			X					X			D98-4944-8
33MW2S	GW1	NA	05/12/1997	1			X								D97-5825-12
	GW2	NA	07/17/1998	2			X					X			D98-4944-9
MW3	GW1	NA	05/12/1997	1			X								D97-5825-9
	GW1D	NA	05/12/1997	1			X								D97-5825-10
	GW2	NA	07/17/1998	2			X					X		Field Duplicate	D98-4944-7
MW4	GW1	NA	05/12/1997	1			X								D97-5825-1
	GW2	NA	07/16/1998	2			X					X			D98-4917-2
33MW4S	GW1	NA	05/12/1997	1			X								D97-5825-2
	GW2	NA	07/15/1998	2			X					X			D98-4890-3
33MW5D	GW1	NA	05/13/1997	1			X								D97-5891-10
	GW1	NA	05/31/1997	1			X								D97-6645-1
	GW2	NA	07/16/1998	2			X			X	X	X			D98-4917-5
33MW5S	GW1	NA	05/12/1997	1			X	X	X						D97-5825-13
	GW2	NA	07/17/1998	2			X			X	X	X			D98-4944-4
	GW2D	NA	07/17/1998	2			X			X	X	X		Field Duplicate	D98-4944-5
33MW5I	GW2	NA	07/17/1998	2			X			X	X	X			D98-4944-6
33MW6D	GW1	NA	05/13/1997	1			X								D97-5891-11
	GW1	NA	05/31/1997	1			X								D97-6645-2
	GW2	NA	07/15/1998	2			X					X			D98-4890-2
33MW7D	GW1	NA	05/12/1997	1			X								D97-5825-7
	GW2	NA	07/16/1998	2			X					X			D98-4917-4
33MW7S	GW1	NA	05/12/1997	1			X								D97-5825-8
	GW2	NA	07/16/1998	2			X					X			D98-4917-3
33MW8S	GW1	NA	05/12/1997	1			X								D97-5825-3
	GW2	NA	07/16/1998	2			X					X			D98-4917-8
33MW9S	GW1	NA	05/12/1997	1			X								D97-5825-4
	GW1MS	NA	05/12/1997	1			X								D97-5825-5
	GW1MSD	NA	05/12/1997	1			X								D97-5825-6
	GW2	NA	07/14/1998	2			X					X		Matrix Spike Duplicate	D98-4875-10
33MW10S	GW2	NA	07/14/1998	2			X					X			D98-4875-4



**Table 22-1**  
**SWMU 33 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field		Chemical Analysis							Comments	Lab ID Number
Point	Designator				VOC 1	VOC 2	VOC	SVOC	TPH	pH	RCRA Metals	Nat. Attn. <sup>1</sup>	Physical Analysis <sup>2</sup>		
33MW10D	GW2	NA	07/14/1998	2			X					X			D98-4875-5
33MW11S	GW2	NA	07/14/1998	2			X			X	X	X			D98-4875-6
33MW11D	GW2	NA	07/14/1998	2			X			X	X	X			D98-4875-7
	GW2MS	NA	07/14/1998	2			X			X	X	X		Matrix Spike	D98-4875-8
	GW2MSD	NA	07/14/1998	2			X			X	X	X		Matrix Spike Duplicate	D98-4875-9
33MW12S	GW2	NA	07/16/1998	2			X			X	X	X			D98-4917-7
33MW12D	GW2	NA	07/16/1998	2			X			X	X	X			D98-4917-6
33MW13S	GW2	NA	07/17/1998	2			X			X	X	X			D98-4944-2
33MW13D	GW2	NA	07/17/1998	2			X			X	X	X			D98-4944-3
33MW14S	GW2	NA	07/14/1998	2			X					X			D98-4875-2
33MW14D	GW2	NA	07/14/1998	2			X					X			D98-4875-1

**Notes:**

ft = feet

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

SVOC = Semivolatile Organic Compounds

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

VOC 1 = trichloroethene, 1,2-dichloroethene, 1,1,1-trichloroethane, vinyl chloride

VOC 2 = benzene, toluene, ethylbenzene, xylenes

<sup>1</sup> = Natural Attenuation Parameters include the following: pH, dissolved oxygen, redox potential (Eh), ferrous iron, nitrate, nitrite, sulfate, sulfide, methane/ethane/ethene, chloride, alkalinity, and total organic carbon (see Appendix T).

<sup>2</sup> = Physical Analysis included the following: Sieve/Hydrometer, Atterberg Limits, Moisture Content, Cation Exchange Capacity, Total Organic Carbon.

<sup>3</sup> = 33MH1 was a water sample taken from a manhole.

<sup>4</sup> = Direct-push refusal was encountered at Borings 33B48 through 33B50.

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B01/DP1 3/31/97 1 5 D97-3879-1	33B01/DP2 3/31/97 5 9 D97-3879-2	33B01/DP3 3/31/97 9 13 D97-3879-3	33B02/DP1 3/31/97 1 5 D97-3879-5	33B02/DP2 3/31/97 5 9 D97-3879-6	33B02/DP3 3/31/97 9 13 D97-3879-7	33B03/DP1 4/8/97 3.2 4.2 D97-4264-4
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.63 U	13.8	6.49 U	6.28 U	65.5	61.9	6.14 U
1,1,2-Trichloroethane	ug/Kg	6.63 U	6.27 U	10.7	6.28 U	6.37	9.37	6.14 U
1,1-Dichloroethane	ug/Kg	6.63 U	9.25	6.49 U	6.28 U	14.8	17.4	6.14 U
1,1-Dichloroethene	ug/Kg	26.3	61.9	12.4	6.28 U	24.6	21.5	6.14 U
1,2-Dichloroethane	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.81	6.14 U
2-Butanone	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
2-Hexanone	ug/Kg	18 J	62.7 U	64.9 U	62.8 U	62.1 U	70.1 U	61.4 U
Acetone	ug/Kg	133 U	125 U	130 U	126 U	124 U	140 U	123 U
Carbon disulfide	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
Chloroform	ug/Kg	6.63 U	8.51	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
cis-1,2-Dichloroethene	ug/Kg	2,570 D	4,510 D	1,440 D	1,700 D	5,070 D	1,750 D	6.14 U
Ethylbenzene	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
m,p-Xylene	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
Methylene chloride	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
o-Xylene	ug/Kg	6.63 U	6.27 U	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
trans-1,2-Dichloroethene	ug/Kg	9.99	19.3	6.49 U	6.28 U	6.21 U	7.01 U	6.14 U
Trichloroethene	ug/Kg	8,100 D	19,800 D	8,260 D	3,290 D	12,400 D	6,730 D	13.6
Vinyl chloride	ug/Kg	9.24	2.51 U	2.59 U	9.07	2.48 U	2.81 U	2.46 U
Total Detected VOCs	UNITS							
Total Volatiles	ug/Kg	10,733.53	24,422.76	9,723.1	4,999.07	17,581.27	8,597.98	13.6

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B03/DP2 4/8/97 7 8 D97-4264-5	33B04/DP1 4/7/97 1.7 2.4 D97-4256-1	33B04/DP1D 4/7/97 1.7 2.4 D97-4256-2 Duplicate	33B04/DP2 4/7/97 8 9 D97-4256-3	33B05/DP1 4/7/97 2.5 3.5 D97-4256-5	33B05/DP2 4/7/97 7 8 D97-4256-6	33B06/DP1 4/7/97 1.6 2.6 D97-4256-7
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
1,1,2-Trichloroethane	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	10.2	6.24 U
1,1-Dichloroethane	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
1,1-Dichloroethene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	7.14	16.5	6.24 U
1,2-Dichloroethane	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
2-Butanone	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
2-Hexanone	ug/Kg	63 U	62.7 U	60.4 U	63.6 U	62.2 U	59 U	62.4 U
Acetone	ug/Kg	126 U	125 U	121 U	69.5 J	124 U	118 U	125 U
Carbon disulfide	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
Chloroform	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	7.7	9.88	6.24 U
cis-1,2-Dichloroethene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	377 D	540 D	24
Ethylbenzene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
m,p-Xylene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
Methylene chloride	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
o-Xylene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
trans-1,2-Dichloroethene	ug/Kg	6.3 U	6.27 U	6.04 U	6.36 U	6.22 U	5.9 U	6.24 U
Trichloroethene	ug/Kg	176	6.27 U	6.04 U	6.36 U	2,560 D	5,860 D	297
Vinyl chloride	ug/Kg	2.52 U	2.51 U	2.42 U	2.54 U	2.49 U	2.36 U	2.5 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>176</b>	<b>ND</b>	<b>ND</b>	<b>69.5</b>	<b>2,951.84</b>	<b>6,436.58</b>	<b>321</b>

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B06/DP2 4/7/97 6 7 D97-4256-8	33B06/DP3 4/7/97 9 10 D97-4256-9	33B07/DP1 4/7/97 2.5 3.5 D97-4256-10	33B07/DP2 4/7/97 6.8 7.8 D97-4256-11	33B08/DP1 4/7/97 1.5 2.5 D97-4256-12	33B08/DP2 4/7/97 6.5 7.5 D97-4256-13	33B08/DP2D 4/7/97 6.5 7.5 D97-4256-14 Duplicate
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
1,1,2-Trichloroethane	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
1,1-Dichloroethane	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
1,1-Dichloroethene	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
1,2-Dichloroethane	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
2-Butanone	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
2-Hexanone	ug/Kg	65 U	64.5 U	63.5 U	63.1 U	67.1 U	66 U	67.5 U
Acetone	ug/Kg	130 U	129 U	127 U	43.9 J	134 U	132 U	56 J
Carbon disulfide	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
Chloroform	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
cis-1,2-Dichloroethene	ug/Kg	112	111	21.3	7.05	6.71 U	6.6 U	6.75 U
Ethylbenzene	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
m,p-Xylene	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
Methylene chloride	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
o-Xylene	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
trans-1,2-Dichloroethene	ug/Kg	6.5 U	6.45 U	6.35 U	6.31 U	6.71 U	6.6 U	6.75 U
Trichloroethene	ug/Kg	296 D	261 D	37.6	6.31 U	6.71 U	6.6 U	6.75 U
Vinyl chloride	ug/Kg	2.6 U	2.58 U	2.54 U	2.53 U	2.68 U	2.64 U	2.7 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>408</b>	<b>372</b>	<b>58.9</b>	<b>50.95</b>	<b>ND</b>	<b>ND</b>	<b>56</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B09/DP1 4/7/97 0.8 1.8 D97-4256-15	33B09/DP2 4/7/97 6 7 D97-4256-16	33B10/DP1 4/8/97 1 2 D97-4264-1	33B10/DP2 4/8/97 7.5 8.5 D97-4264-2	33B13/DP1 4/8/97 4 5 D97-4264-10	33B13/DP2 4/8/97 8 9 D97-4264-11	33B14/DP1 4/8/97 2.1 3.1 D97-4264-12
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
1,1,2-Trichloroethane	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
1,1-Dichloroethane	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
1,1-Dichloroethene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
1,2-Dichloroethane	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
2-Butanone	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
2-Hexanone	ug/Kg	64.7 U	63.9 U	52.5 U	64.7 U	70.2 U	68.3 U	67.3 U
Acetone	ug/Kg	422	128 U	124	157	54.1 J	137 U	64.3 J
Carbon disulfide	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
Chloroform	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
cis-1,2-Dichloroethene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	83.2
Ethylbenzene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
m,p-Xylene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
Methylene chloride	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
o-Xylene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
trans-1,2-Dichloroethene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	7.02 U	6.83 U	6.73 U
Trichloroethene	ug/Kg	6.47 U	6.39 U	5.25 U	6.47 U	27.7	33.2	5,070 D
Vinyl chloride	ug/Kg	2.59 U	2.55 U	2.1 U	2.59 U	2.81 U	2.73 U	2.69 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>422</b>	<b>ND</b>	<b>124</b>	<b>157</b>	<b>81.8</b>	<b>33.2</b>	<b>5,217.5</b>

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B14/DP2 4/8/97 5 6 D97-4264-13	33B15/DP1 4/9/97 1.5 2.5 D97-4344-1	33B15/DP2 4/9/97 6.5 7.5 D97-4344-2	33B15/DP3 4/9/97 9.5 10.5 D97-4344-3	33B16/DP1 4/9/97 1 2 D97-4344-4	33B16/DP2 4/9/97 6 7 D97-4344-5	33B17/DP1 4/9/97 3 4 D97-4344-6
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
1,1,2-Trichloroethane	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
1,1-Dichloroethane	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	17.2
1,1-Dichloroethene	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
1,2-Dichloroethane	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
2-Butanone	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
2-Hexanone	ug/Kg	63.9 U	65.5 U	61.7 U	63.5 U	66.1 U	63.5 U	65.2 U
Acetone	ug/Kg	128 U	59.9 J	63 J	127 U	52.8 J	127 U	89.2 J
Carbon disulfide	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
Chloroform	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
cis-1,2-Dichloroethene	ug/Kg	123	55.3	168	195	31.6	8.65	6.52 U
Ethylbenzene	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
m,p-Xylene	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
Methylene chloride	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
o-Xylene	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
trans-1,2-Dichloroethene	ug/Kg	6.39 U	6.55 U	6.17 U	6.35 U	6.61 U	6.35 U	6.52 U
Trichloroethene	ug/Kg	2,310 D	577 D	1,010 D	404 D	202	398 D	6.52 U
Vinyl chloride	ug/Kg	2.55 U	2.62 U	2.47 U	2.54 U	2.64 U	2.54 U	2.61 U
Total Detected VOCs	UNITS							
Total Volatiles	ug/Kg	2,433	692.2	1,241	599	286.4	406.65	106.4

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J\* - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B17/DP2 4/9/97 5.5 6.5 D97-4344-7	33B18/DP1 4/9/97 2.5 5 D97-4344-8	33B18/DP2 4/9/97 5 6 D97-4344-11	33B19/DP1 4/9/97 4 5 D97-4344-13	33B19/DP2 4/9/97 5.5 8 D97-4344-14	33B29A/DP1 6/4/98 0 4 D98-4166-7	33B29A/DP2 6/4/98 4 8 D98-4166-8
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
1,1,2-Trichloroethane	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
1,1-Dichloroethane	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
1,1-Dichloroethene	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
1,2-Dichloroethane	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
2-Butanone	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	5.09 J	6.38 U
2-Hexanone	ug/Kg	305 DU	64.1 U	67.7 U	72.7 U	63 U	28.1 J	63.8 U
Acetone	ug/Kg	127 DJ	128 U	700 D	201	57.7 J	127 U	128 U
Carbon disulfide	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
Chloroform	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
cis-1,2-Dichloroethene	ug/Kg	30.5 DU	6.41 U	6.77 U	57.6	85.6	6.35 U	6.38 U
Ethylbenzene	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
m,p-Xylene	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
Methylene chloride	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
o-Xylene	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
trans-1,2-Dichloroethene	ug/Kg	30.5 DU	6.41 U	6.77 U	7.27 U	6.3 U	6.35 U	6.38 U
Trichloroethene	ug/Kg	30.5 DU	6.41 U	6.77 U	19.8	6.3 U	36.6	8.44
Vinyl chloride	ug/Kg	12.2 DU	2.56 U	2.71 U	2.91 U	2.52 U	2.54 U	2.55 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>127</b>	<b>ND</b>	<b>700</b>	<b>278.4</b>	<b>143.3</b>	<b>69.79</b>	<b>8.44</b>

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B29A/DP3 6/4/98 8 12 D98-4166-11	33B29A/DP4 6/4/98 12 16 D98-4166-12	33B30A/DP1 6/4/98 0 4 D98-4166-2	33B30A/DP2 6/4/98 4 8 D98-4166-3	33B30A/DP2D 6/4/98 4 8 D98-4166-4 Duplicate	33B30A/DP3 6/4/98 8 12 D98-4166-5	33B30A/DP4 6/4/98 12 16 D98-4166-6
Volatiles	UNITS							
1,1,1-Trichloroethane	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
1,1,2-Trichloroethane	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
1,1-Dichloroethane	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
1,1-Dichloroethene	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
1,2-Dichloroethane	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
2-Butanone	ug/Kg	6.84 U	6.74 U	6.33 U	5 J	3.39 J	13.4 J*	32 DU
2-Hexanone	ug/Kg	68.4 U	67.4 U	63.3 U	58.8 U	58.7 U	62 U	320 DU
Acetone	ug/Kg	137 U	135 U	127 U	118 U	117 U	124 U	640 DU
Carbon disulfide	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
Chloroform	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
cis-1,2-Dichloroethene	ug/Kg	6.84 U	6.74 U	6.33 U	114	67.3 J*	18.5 J*	65.7 D
Ethylbenzene	ug/Kg	6.84 U	1.41 J	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
m,p-Xylene	ug/Kg	6.84 U	10.4	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
Methylene chloride	ug/Kg	5.57 J	5.36 J	6.33 U	5.88 U	5.87 U	6.2 U	8.43 DJ
o-Xylene	ug/Kg	6.84 U	3.96 J	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
trans-1,2-Dichloroethene	ug/Kg	6.84 U	6.74 U	6.33 U	5.88 U	5.87 U	6.2 U	32 DU
Trichloroethene	ug/Kg	31.9 J*	335 DJ*	6.75	38.3	29.5 J*	101 J*	325 D
Vinyl chloride	ug/Kg	2.74 U	2.69 U	2.53 U	2.35 U	2.35 U	2.48 U	12.8 DU
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>37.47</b>	<b>356.13</b>	<b>6.75</b>	<b>157.3</b>	<b>100.19</b>	<b>132.9</b>	<b>399.13</b>

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-2**  
**SWMU 33 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B32A/DP1 6/2/98 0 4 D98-4081-1	33B32A/DP2 6/2/98 4 8 D98-4081-2	33B32A/DP3 6/2/98 8 12 D98-4081-3	33B32A/DP3D 6/2/98 8 12 D98-4081-4 Duplicate	33B32A/DP4 6/2/98 12 16 D98-4081-5
Volatiles	UNITS					
1,1,1-Trichloroethane	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	3.61 J
1,1,2-Trichloroethane	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
1,1-Dichloroethane	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
1,1-Dichloroethene	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
1,2-Dichloroethane	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
2-Butanone	ug/Kg	6.46 U	5.61 U	5.41 J	6.38 U	6.27 U
2-Hexanone	ug/Kg	64.6 U	56.1 U	60.9 U	63.8 U	62.7 U
Acetone	ug/Kg	129 U	112 U	122 U	128 U	125 U
Carbon disulfide	ug/Kg	6.46 U	5.61 U	6.47 J*	6.38 U	6.27 U
Chloroform	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
cis-1,2-Dichloroethene	ug/Kg	6.46 U	5.61 U	11.9 J*	6.05 J	6.84 J*
Ethylbenzene	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
m,p-Xylene	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
Methylene chloride	ug/Kg	3.03 J	2.01 J	2.06 J	3.06 J	6.27 U
o-Xylene	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
trans-1,2-Dichloroethene	ug/Kg	6.46 U	5.61 U	6.09 U	6.38 U	6.27 U
Trichloroethene	ug/Kg	6.46 U	2.97 JU*	6.09 U	6.38 U	9.41 J*
Vinyl chloride	ug/Kg	2.59 U	2.24 U	2.44 U	2.55 U	2.51 U
<b>Total Detected VOCs</b>	<b>UNITS</b>					
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>3.03</b>	<b>2.01</b>	<b>25.84</b>	<b>9.11</b>	<b>19.86</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-3**  
**SWMU 33 Phases 1 and 2 Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33MW2S/CS1 5/7/97 1 5 D97-5623-2	33MW2S/CS2 5/7/97 7 7.5 D97-5623-3	33MW2S/CS3 5/7/97 14 15 D97-5623-4	33MW2S/CS4 5/7/97 19 20 D97-5623-5	33MW5I/SB1 6/16/98 8 10 D98-4394-1	33MW5I/SB2 6/16/98 11 12 D98-4394-2	33B56/SB1 6/17/98 13 15 D98-4412-1
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/Kg	12.8	22.7	7.45 U	7.13 U	7.35 UJ*	6.66 U	32.9 DU
1,1,2-Trichloroethane	ug/Kg	10.7	14.2	12.1	7.13 U	7.35 UJ*	6.66 U	32.9 DU
1,1-Dichloroethane	ug/Kg	21.7	22.8	14.4	7.13 U	7.35 UJ*	6.66 U	32.9 DU
1,1-Dichloroethene	ug/Kg	27.9	37.8	17.1	8	7.35 UJ*	6.66 U	32.9 DU
2-Hexanone	ug/Kg	62 U	6.9 J	74.5 U	71.3 U	73.5 UJ*	66.6 U	329 DU
Acetone	ug/Kg	124 U	128 U	149 U	45.9 J	147 UJ*	133 U	189 DJ
Benzene	ug/Kg	6.2 U	6.41 U	7.45 U	7.13 U	2.6 J	6.66 U	32.9 DU
cis-1,2-Dichloroethene	ug/Kg	4,440 D	6,180 D	778 D	215	7.35 UJ*	6.66 U	32.9 DU
o-Xylene	ug/Kg	6.2 U	6.41 U	7.45 U	7.13 U	7.35 UJ*	6.66 U	32.9 DU
trans-1,2-Dichloroethene	ug/Kg	45.6	36.4	9.78	7.13 U	7.35 UJ*	6.66 U	32.9 DU
Trichloroethene	ug/Kg	2,600 D	10,800 D	4,950 D	1,210 D	7.35 UJ*	6.66 U	32.9 DU
Vinyl chloride	ug/Kg	195	132	2.98 U	2.85 U	2.94 UJ*	2.66 U	13.1 DU
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>7,353.7</b>	<b>17,252.8</b>	<b>5,781.38</b>	<b>1,478.9</b>	<b>2.6</b>	<b>ND</b>	<b>189</b>
<b>Semivolatiles</b>	<b>UNITS</b>							
2-Methylnaphthalene	mg/Kg	NA	NA	NA	NA	NA	NA	15.4 D
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>15.4</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-3**  
**SWMU 33 Phases 1 and 2 Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point:		33B56/SB2
Date Sampled:		6/17/98
Sample Depth From:		15
Sample Depth To:		17
Laboratory Number:		D98-4412-2
Sample Type:		
<b>Volatiles</b>	<b>UNITS</b>	
1,1,1-Trichloroethane	ug/Kg	6.35 U
1,1,2-Trichloroethane	ug/Kg	6.35 U
1,1-Dichloroethane	ug/Kg	6.3 J
1,1-Dichloroethene	ug/Kg	6.35 U
2-Hexanone	ug/Kg	63.5 U
Acetone	ug/Kg	53.6 J
Benzene	ug/Kg	6.35 U
cis-1,2-Dichloroethene	ug/Kg	11.8
o-Xylene	ug/Kg	1.56 J
trans-1,2-Dichloroethene	ug/Kg	6.35 U
Trichloroethene	ug/Kg	6.35 U
Vinyl chloride	ug/Kg	16.6
<b>Total Detected VOCs</b>	<b>UNITS</b>	
Total Volatiles	ug/Kg	89.86
<b>Semivolatiles</b>	<b>UNITS</b>	
2-Methylnaphthalene	mg/Kg	0.419 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>	
Total Semi-Volatiles	mg/Kg	ND

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-4**  
**SWMUs 17 and 33 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		17B04A/DW1 4/21/97 16 18 D97-4833-8	17B06/DW1 4/21/97 11.5 12.5 D97-4833-2	17B08/DW1 4/21/97 13 15 D97-4833-3	17B09/DW1 4/21/97 16 18 D97-4833-9	17B10/DW1 5/14/98 15 17 D98-3694-3	33B22A/DW1 4/18/97 25 25.5 D97-4807-1	33B22A/DW1D 4/18/97 25 25.5 D97-4807-2 Duplicate
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	5 U	5 U	36.3	3.77 J	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	7.72	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	5 U	23.9	5 U	5 U	5 U	5 U
1,1-Dichloroethene	ug/L	13.8	5 U	108	7.91	5 U	5 U	5 U
Benzene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	7.7	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	1,360 D	535 D	5,460 D	931 D	23.1	5 U	5 U
Ethylbenzene	ug/L	5 U	5 U	5 U	5 U	2.97 J	5 U	5 U
Tetrachloroethene	ug/L	5 U	5 U	4.99 J	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	9.6	5 U	76.2	6.75	8.72	5 U	5 U
Trichloroethene	ug/L	1,870 D	1,420 D	16,500 D	1,940 D	5 U	5 U	5 U
Vinyl chloride	ug/L	173	17	139	7.87	7.58	2 U	2 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/L</b>	<b>3,426.4</b>	<b>1,972</b>	<b>22,363.81</b>	<b>2,897.3</b>	<b>42.37</b>	<b>ND</b>	<b>ND</b>
<b>Semivolatiles</b>	<b>UNITS</b>							
4-Chloroaniline	ug/L	20.4 U	20 U	21 U	20 U	NA	NA	NA
4-Methylphenol	ug/L	10.2 U	10 U	10.5 U	10 U	NA	NA	NA
Naphthalene	ug/L	10.2 U	10 U	10.5 U	10 U	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>ug/L</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	NA	0.01 J	0.01 U	0.01 U	NA	NA	NA
Barium, Dissolved	mg/L	NA	0.133	0.0603	0.0268	NA	NA	NA
Cadmium, Dissolved	mg/L	NA	0.0036 J	0.005 U	0.005 U	NA	NA	NA
Chromium, Dissolved	mg/L	NA	0.0164	0.0022 J	0.01 U	NA	NA	NA
Lead, Dissolved	mg/L	NA	0.115	0.003 U	0.003 U	NA	NA	NA
Silver, Dissolved	mg/L	NA	0.0033 J	0.02 U	0.02 U	NA	NA	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	NA	6.7 J*	6.6 J*	6.6 J*	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-4**  
**SWMUs 17 and 33 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		33B41/DW1 4/16/97 18 20 D97-4731-3	33B45/DW1 4/17/97 18 20 D97-4731-6	33B46/DW1 4/17/97 18 20 D97-4731-5	33B47/DW1 4/17/97 8 10 D97-4731-4	33B51/DW1 4/18/97 18 20 D97-4807-3	33B54/DW1 5/14/98 13 17 D98-3694-1	33B55/DW1 5/14/98 13 17 D98-3694-2
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	NA	5 U	5 U	19.9 U	5 U	5 U
1,1-Dichloroethene	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
Benzene	ug/L	5 U	NA	5 U	5 U	17.8 U	5 U	5 U
Chloroform	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	5 U	NA	5 U	5 U	5.74 U	5 U	5 U
Ethylbenzene	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	5 U	NA	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	ug/L	2 U	NA	2 U	2 U	248 U	2 U	2 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
Total Volatiles	ug/L	ND	NA	ND	ND	291.44	ND	ND
<b>Semivolatiles</b>	<b>UNITS</b>							
4-Chloroaniline	ug/L	NA	20 UR	308 DUR	4.1 J	NA	NA	NA
4-Methylphenol	ug/L	NA	10 UR	154 DUR	2.8 J	NA	NA	NA
Naphthalene	ug/L	NA	10 UR	154 DUR	2.9 J	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
Total Semi-Volatiles	ug/L	NA	ND	ND	9.8	NA	NA	NA
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
Lead, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
Silver, Dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-4**  
**SWMUs 17 and 33 Phases 1 and 2 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		33MW6D/DW1	
Date Sampled:		4/17/97	
Sample Depth From:		12	
Sample Depth To:		20	
Laboratory Number:		D97-4731-2	
Sample Type:			
<b>Volatiles</b>	<b>UNITS</b>		
1,1,1-Trichloroethane	ug/L	5	U
1,1,2-Trichloroethane	ug/L	5	U
1,1-Dichloroethane	ug/L	5	U
1,1-Dichloroethene	ug/L	5	U
Benzene	ug/L	5	U
Chloroform	ug/L	5	U
cis-1,2-Dichloroethene	ug/L	5	U
Ethylbenzene	ug/L	5	U
Tetrachloroethene	ug/L	5	U
trans-1,2-Dichloroethene	ug/L	5	U
Trichloroethene	ug/L	5	U
Vinyl chloride	ug/L	60.9	
<b>Total Detected VOCs</b>	<b>UNITS</b>		
Total Volatiles	ug/L	60.9	
<b>Semivolatiles</b>	<b>UNITS</b>		
4-Chloroaniline	ug/L	NA	
4-Methylphenol	ug/L	NA	
Naphthalene	ug/L	NA	
<b>Total Detected SVOCs</b>	<b>UNITS</b>		
Total Semi-Volatiles	ug/L	NA	
<b>Metals, Dissolved</b>	<b>UNITS</b>		
Arsenic, Dissolved	mg/L	NA	
Barium, Dissolved	mg/L	NA	
Cadmium, Dissolved	mg/L	NA	
Chromium, Dissolved	mg/L	NA	
Lead, Dissolved	mg/L	NA	
Silver, Dissolved	mg/L	NA	
<b>Water Quality Parameters</b>	<b>UNITS</b>		
pH	SU	NA	

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 22-5**  
**SWMU 33 Area Phase 1 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW2S/GW1 5/12/97 D97-5825-12	33MW2/GW1 5/12/97 D97-5825-11	33MW3/GW1 5/12/97 D97-5825-9	33MW3/GW1D 5/12/97 D97-5825-10 Duplicate	33MW4S/GW1 5/12/97 D97-5825-2	33MW4/GW1 5/12/97 D97-5825-1	33MW5S/GW1 5/12/97 D97-5825-13
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	50.8	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	80.7	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	103	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	ug/L	369 DJ	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	18.6	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	57.5	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	8,400 D	963 D	21.9	19.1	5 U	5 U	403 D
Tetrachloroethene	ug/L	10.1	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	ug/L	15.4	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	106	14.1	5 U	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	132,000 D	21	32.1	26.3	5 U	5 U	279
Vinyl chloride	ug/L	64.4	1,880 D	19.1	17.6	2 U	2 U	30.6
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/L</b>	<b>141,275.5</b>	<b>2,878.1</b>	<b>73.1</b>	<b>63</b>	<b>ND</b>	<b>ND</b>	<b>712.6</b>
<b>Semivolatiles</b>	<b>UNITS</b>							
		NA	NA	NA	NA	NA	NA	ND

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-5**  
**SWMU 33 Area Phase 1 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW5D/GW1 5/30/97 D97-6645-1	33MW6D/GW1 5/30/97 D97-6645-2	33MW7S/GW1 5/12/97 D97-5825-8	33MW7D/GW1 5/12/97 D97-5825-7	33MW8S/GW1 5/12/97 D97-5825-3	33MW9S/GW1 5/12/97 D97-5825-4
<b>Volatiles</b>	<b>UNITS</b>						
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	10.5	5 U
Tetrachloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	5 U	5 U	5 U	5 U	26	5 U
Vinyl chloride	ug/L	2 U	2 U	2 U	2 U	2 U	2 U
<b>Total Detected VOCs</b>	<b>UNITS</b>						
<b>Total Volatiles</b>	<b>ug/L</b>	ND	ND	ND	ND	36.5	ND
<b>Semivolatiles</b>	<b>UNITS</b>						
		NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinseate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-6**  
**SWMU 33 Area Phase 2 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW2S/GW2 07/17/1998 D98-4944-9	33MW2/GW2 07/17/1998 D98-4944-8	33MW3/GW2 07/17/1998 D98-4944-7	33MW4S/GW2 07/15/1998 D98-4890-3	33MW4/GW2 07/16/1998 D98-4917-2	33MW5S/GW2 07/17/1998 D98-4944-4	33MW5S/GW2D 07/17/1998 D98-4944-5 Duplicate
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	75 J*	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	42.4 J*	2.7 J	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	126 J*	20.2 J	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	ug/L	2,500 DUJ*	90.8 J	2.42 J	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	15.1 J*	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene	ug/L	NA	NA	NA	NA	NA	NA	NA
Benzene	ug/L	2.02 J	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	42.7 J*	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	58,700 DJ*	3,100 D	326 D	5 U	5 U	386 D	350 D
Methylene chloride	ug/L	5.93 J*	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	23.1 J*	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	ug/L	14.8 J*	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	2,500 DUJ*	15.7 J	5 U	5 U	5 U	5 U	2.96 J
Trichloroethene	ug/L	67,700 DJ*	5,230 D	35.1 J	5 U	5 U	19.2 J	19.6 J
Vinyl chloride	ug/L	1,100 DJ*	583 D	148 J	2 U	2 U	26.6 J	24.3 J
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/L</b>	<b>127,847.05</b>	<b>9,042.4</b>	<b>511.52</b>	<b>ND</b>	<b>ND</b>	<b>431.8</b>	<b>396.86</b>
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	NA	NA	NA	NA	NA	0.01 U	0.01 U
Barium, Dissolved	mg/L	NA	NA	NA	NA	NA	0.235 U	0.225 U
Cadmium, Dissolved	mg/L	NA	NA	NA	NA	NA	0.005 U	0.005 U
Chromium, Dissolved	mg/L	NA	NA	NA	NA	NA	0.0023 J	0.0025 J
Lead, Dissolved	mg/L	NA	NA	NA	NA	NA	0.003 U	0.003 U
Silver, Dissolved	mg/L	NA	NA	NA	NA	NA	0.005 U	0.005 U
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	NA	NA	6.8 J*	7.4 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-6**  
**SWMU 33 Area Phase 2 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW5/GW2 07/17/1998 D98-4944-6	33MW5D/GW2 07/16/1998 D98-4917-5	33MW6D/GW2 07/15/1998 D98-4890-2	33MW7S/GW2 07/16/1998 D98-4917-3	33MW7D/GW2 07/16/1998 D98-4917-4	33MW8S/GW2 07/16/1998 D98-4917-8	33MW9S/GW2 07/14/1998 D98-4875-10
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
1,1-Dichloroethane	ug/L	5.49	5 U	5 U	5 U	5 U	4.63 J	5 UJ*
1,1-Dichloroethene	ug/L	10.5	5 U	5 U	5 U	5 U	3.14 J	5 UJ*
1,2-Dichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
1,2-Dichloroethene	ug/L	NA	NA	NA	NA	NA	NA	NA
Benzene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
Chloroform	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
cis-1,2-Dichloroethene	ug/L	1,150 D	5 U	5 U	5 U	5 U	12.2	7.15 J*
Methylene chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
Tetrachloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
Toluene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ*
trans-1,2-Dichloroethene	ug/L	6.19	5 U	5 U	5 U	5 U	5 U	5 UJ*
Trichloroethene	ug/L	806 D	5 U	5 U	5 U	5 U	51.7	5 UJ*
Vinyl chloride	ug/L	12.4	2 U	2 U	2 U	2 U	2 U	2 UJ*
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/L</b>	<b>1,990.58</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>	<b>71.67</b>	<b>7.15</b>
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	0.0148	0.021	NA	NA	NA	NA	NA
Barium, Dissolved	mg/L	0.315	1.31	NA	NA	NA	NA	NA
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	NA	NA	NA	NA	NA
Chromium, Dissolved	mg/L	0.0026 J	0.0023 J	NA	NA	NA	NA	NA
Lead, Dissolved	mg/L	0.003 U	0.003 U	NA	NA	NA	NA	NA
Silver, Dissolved	mg/L	0.005 U	0.005 U	NA	NA	NA	NA	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	6.9 J*	6.8 J*	NA	NA	NA	NA	NA

LEGEND: B - Detected in the associated laboratory method blank F - Detected in the associated equipment rinse blank J - Qualified as estimated by the laboratory  
R - Qualified as unusable in the QC evaluation T - Detected in associated trip blank U - Qualified as undetected by the laboratory  
NA - Not Analyzed ND - Not Detected D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-6**  
**SWMU 33 Area Phase 2 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW10S/GW2 07/14/1998 D98-4875-4	33MW10D/GW2 07/14/1998 D98-4875-5	33MW10D/GW2 09/21/1998 366821	33MW11S/GW2 07/14/1998 D98-4875-6	33MW11D/GW2 07/14/1998 D98-4875-7	33MW12S/GW2 07/16/1998 D98-4917-7	33MW12D/GW2 07/16/1998 D98-4917-6
<b>Volatiles</b>	<b>UNITS</b>							
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	4.32 J	2.9 J	5 U	2.92 J	5 U	5 U
1,1-Dichloroethene	ug/L	5 U	5 U	2.2 J	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene	ug/L	NA	NA	65	NA	NA	NA	NA
Benzene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	5 U	74.4	63	5 U	5 U	5 U	5 U
Methylene chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	ug/L	2 U	9.05	4.1	2 U	2 U	2 U	2 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/L</b>	<b>ND</b>	<b>87.77</b>	<b>137.2</b>	<b>ND</b>	<b>2.92</b>	<b>ND</b>	<b>ND</b>
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Barium, Dissolved	mg/L	NA	NA	NA	0.47	0.858	0.0837	0.677
Cadmium, Dissolved	mg/L	NA	NA	NA	0.005 U	0.005 U	0.0035 J	0.0013 J
Chromium, Dissolved	mg/L	NA	NA	NA	0.0029 J	0.0023 J	0.0035 J	0.005 U
Lead, Dissolved	mg/L	NA	NA	NA	0.003 U	0.003 U	0.0026 J	0.0146
Silver, Dissolved	mg/L	NA	NA	NA	0.0024 J	0.005 U	0.0046 J	0.0108
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	NA	NA	NA	6.7 J*	7 J*	6 J*	6.9 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-6**  
**SWMU 33 Area Phase 2 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW13S/GW2 07/17/1998 D98-4944-2	33MW13D/GW2 07/17/1998 D98-4944-3	33MW14S/GW2 07/14/1998 D98-4875-2	33MW14D/GW2 07/14/1998 D98-4875-1
<b>Volatiles</b>	<b>UNITS</b>				
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	5 U	5 U	5 U
1,1-Dichloroethene	ug/L	5 U	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	5 U	5 U	5 U	5 U
1,2-Dichloroethene	ug/L	NA	NA	NA	NA
Benzene	ug/L	5 U	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U
Methylene chloride	ug/L	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	5 U	5 U	5 U	5 U
Toluene	ug/L	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U
Trichloroethene	ug/L	3.79 JU*	5 U	5 U	5 U
Vinyl chloride	ug/L	2 U	2 U	2 U	2 U
<b>Total Detected VOCs</b>	<b>UNITS</b>				
Total Volatiles	ug/L	ND	ND	ND	ND
<b>Metals, Dissolved</b>	<b>UNITS</b>				
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	NA	NA
Barium, Dissolved	mg/L	0.047	0.61	NA	NA
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	NA	NA
Chromium, Dissolved	mg/L	0.004 J	0.005 U	NA	NA
Lead, Dissolved	mg/L	0.003 U	0.003 U	NA	NA
Silver, Dissolved	mg/L	0.005 U	0.005 U	NA	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>				
pH	SU	5.1 J*	6.8 J*	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 22-7**  
**SWMU 33 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (µg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Results (µg/kg)
1,1-Dichloroethene	60	33B01 / DP2	5 - 9	61.9
cis-1,2-Dichloroethene	400	33B01 / DP1	1 - 5	2,570 D
		33B01 / DP2	5 - 9	4,510 D
		33B01 / DP3	9 - 13	1,440 D
		33B02 / DP1	1 - 5	1,700 D
		33B02 / DP2	5 - 9	5,070 D
		33B02 / DP3	9 - 13	1,750 D
		33B05 / DP2	7 - 8	540 D
		33MW2S / CS1	1 - 5	4,440 D
		33MW2S / CS2	7 - 7.5	6,180 D
		33MW2S / CS3	14 - 15	778 D
Trichloroethene	60	33B01 / DP1	1 - 5	8,100 D
		33B01 / DP2	5 - 9	19,800 D
		33B01 / DP3	9 - 13	8,260 D
		33B02 / DP1	1 - 5	3,290 D
		33B02 / DP2	5 - 9	12,400 D
		33B02 / DP3	9 - 13	6,730 D
		33B03 / DP2	7 - 8	176
		33B05 / DP1	2.5 - 3.5	2,560 D
		33B05 / DP2	7 - 8	5,860 D
		33B06 / DP1	1.6 - 2.6	297
		33B06 / DP2	6 - 7	296 D
		33B06 / DP3	9 - 10	261 D
		33B14 / DP1	2.1 - 3.1	5,070 D
		33B14 / DP2	5 - 6	2,310 D
		33B15 / DP1	1.5 - 2.5	577 D
		33B15 / DP2	6.5 - 7.5	1,010 D
		33B15 / DP3	9.5 - 10.5	404 D
		33B16 / DP1	1 - 2	202
		33B16 / DP2	6 - 7	398 D
		33B29A / DP4	12 - 16	335 DJ*
		33B30A / DP3	8 - 12	101 J*
		33B30A / DP4	12 - 16	325 D
		33MW2S / CS1	1 - 5	2,600 D
		33MW2S / CS2	7 - 7.5	10,800 D
		33MW2S / CS3	14 - 15	4,950 D
		33MW2S / CS4	19 - 20	1,210 D
Vinyl Chloride	10	33MW2S / CS1	1 - 5	195
		33MW2S / CS2	7 - 7.5	132
		33B56 / SB2	15 - 17	16.6

Notes:

D = Sample was diluted for analysis.

DAF = Dilution Attenuation Factor

ft = feet

J\* = Qualified as estimated by BMWCI during the QC evaluation.

SSL = Soil Screening Level



**Table 22-8**  
**SWMU 33 Area Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
<b>Volatiles</b>	<b>(µg/L)</b>			<b>(µg/L)</b>
Benzene	5	33B51 / DW1	18 - 20	17.8
1,1,2-Trichloroethane	5	17B08 / DW1	13 - 15	7.72
		33MW2S / GW1	NA	80.7
		33MW2S / GW2	NA	42.4 J*
1,1-Dichloroethene	7	17B04A / DW1	16 - 18	13.8
		17B08 / DW1	13 - 15	108
		17B09 / DW1	16 - 18	7.91
		33MW2 / GW2	NA	90.8
		33MW2S / GW1	NA	369 DJ
		33MW5I / GW2	NA	10.5
1,2-Dichloroethane	5	33MW2S / GW1	NA	18.6
		33MW2S / GW2	NA	15.1 J*
cis-1,2-Dichloroethene	70	17B04A / DW1	16 - 18	1,360 D
		17B06 / DW1	11.5 - 12.5	535 D
		17B08 / DW1	13 - 15	5,460 D
		17B09 / DW1	16 - 18	931 D
		33MW2S / GW1	NA	8,400 D
		33MW2S / GW2	NA	58700 DJ*
		33MW2 / GW1	NA	963 D
		33MW2 / GW2	NA	3100 D
		33MW3 / GW2	NA	326 D
		33MW5S / GW1	NA	403 D
		33MW5S / GW2	NA	386 D
		33MW5S / GW2D	NA	350 D
		33MW5I / GW2	NA	1150 D
		33MW10D / GW2	NA	74.4
trans-1,2-Dichloroethene	100	33MW2S / GW1	NA	106
Methylene Chloride	5	33MW2S / GW2	NA	5.93 J*
Tetrachloroethene	5	33MW2S / GW1	NA	10.1
		33MW2S / GW2	NA	23.1 J*
Trichloroethene	5	17B04A / DW1	16 - 18	1,870 D
		17B06 / DW1	11.5 - 12.5	1,420 D
		17B08 / DW1	13 - 15	16,500 D
		17B09 / DW1	16 - 18	1,940 D
		33MW2S / GW1	NA	132,000 D
		33MW2S / GW2	NA	67700 D
		33MW2 / GW1	NA	21
		33MW2 / GW2	NA	5230 D
		33MW3 / GW1	NA	32.1
		33MW3 / GW1D	NA	26.3
		33MW3 / GW2	NA	35.1
		33MW5S / GW1	NA	279
		33MW5S / GW2	NA	19.2
		33MW5S / GW2D	NA	19.6
		33MW5I / GW2	NA	806 D
		33MW8S / GW1	NA	26
		33MW8S / GW2	NA	51.7
Vinyl Chloride	2	17B04A / DW1	16 - 18	173
		17B06 / DW1	11.5 - 12.5	17
		17B08 / DW1	13 - 15	139
		17B09 / DW1	16 - 18	7.87
		17B10 / DW1	15 - 17	7.58
		33B51 / DW1	18 - 20	248

**Table 22-8**  
**SWMU 33 Area Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
Vinyl Chloride (continued)	2	33MW6D / DW1	12 - 20	60.9
		33MW2S / GW1	NA	64.4
		33MW2S / GW2	NA	1100 DJ*
		33MW2 / GW1	NA	1,880 D
		33MW2 / GW2	NA	583 D
		33MW3 / GW1	NA	19.1
		33MW3 / GW1D	NA	17.6
		33MW3 / GW2	NA	148
		33MW5S / GW1	NA	30.6
		33MW5S / GW2	NA	26.6
		33MW5S / GW2D	NA	24.3
		33MW5I / GW2	NA	12.4
		33MW10D / GW2	NA	9.05
		33MW10D / GW2**	NA	4.1
<b>Metals</b>	<b>(mg/L)</b>			<b>(mg/L)</b>
Lead, Dissolved	0.015	17B06 / DW1	11.5 - 12.5	0.115

Notes:

D = Sample was diluted for analysis.

ft = feet

J = Estimated value; concentration below practical quantitation limit.

J\* = Qualified as estimated by BMWCI during the QC evaluation.

MCL = Maximum Contaminant Level

\*\* = Second sample was collected 2 months after initial sample to confirm detections.

**SWMU 12**  
**AMOCO LANDFARM**  
**(ARMCO PROPERTY, AMOCO LEASED)**

## **14.0 SWMU 12 – AMOCO LANDFARM**

### **14.1 SWMU BACKGROUND**

#### **14.1.1 Description of SWMU**

SWMU 12 (see Figure 1-2) was utilized by Amoco from 1975 through 1979 for the landfarming of petroleum refining waste generated at the Amoco Sugar Creek Refinery. SWMU 12 is located on Armco property that was leased to Amoco from December 1973 through September 1980. SWMU 12 covers an area of approximately ten acres.

Amoco hauled petroleum refining waste to SWMU 12 by truck from the refinery which is located east of SWMU 12. The waste was incorporated into the soil by surface spreading and disking. Based upon information provided to Armco by Amoco, approximately 30,000 tons of petroleum refining waste were placed in SWMU 12 during its five years of operation. It has been estimated that 3 to 8 inches of petroleum refining waste were incorporated into the soil each year (WWC, 1980). An estimated total of 24 inches of waste, having a wet weight of 30,000 tons and a dry weight of 15,000 tons, was managed at SWMU 12. Water decanted from the sludge material and precipitation falling on the SWMU were controlled by a dike that surrounds the SWMU. Two culverts were located through the dike so that surface water could be discharged from the area, as necessary. No information is available regarding the quality or quantity of water discharged from SWMU 12 during operation. The culvert gates appeared to be closed during a visit by Armco and BMWCI personnel to the SWMU in early 1995; however, one of the culverts had been silted in and was not visible from the ground surface.

The only known waste activity conducted by Armco at SWMU 12 involved a one-time land application of liquid and sludge sediment generated during the cleaning of a No. 2 fuel oil tank. This activity is believed to have taken place in 1976 or 1977. Although the exact quantity of material associated with this activity cannot be determined, it is anticipated that the quantity was much less than 10,000 gallons. The capacity of a No. 2 fuel oil tank was 10,000 gallons, and it is known that the product was removed from the tank long before this activity took place. The

material transported to SWMU 12 was limited to the residual material remaining at the bottom of the tank. The material was transported to SWMU 12 in a single trip by a vacuum truck. Although the actual quantity of material is unknown, it is not anticipated to have exceeded a few hundred gallons.

In a 103(c) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) notification to USEPA, Amoco classified the materials disposed in SWMU 12 under hazardous waste codes K048, K049, K050, and K051 (Helffrich, 1981). The basis for the listing of these waste codes is the presence of lead and hexavalent chromium. At the time that the petroleum refining waste was managed at SWMU 12, it was not classified as hazardous waste. Samples taken from sludge-incorporated soil passed the Extraction Procedure for Toxicity (EP-Toxicity) testing for chromium and lead, two of the constituents for which such waste was subsequently listed by USEPA (WWC, 1980).

During the flood of 1993, SWMU 12 was covered by floodwaters. The SWMU may have been affected by water and silt carried in during the flood conditions. The surface of SWMU 12 does not appear to be eroded; however, the presence of approximately 6-inches of sediment deposited during the flood conditions of 1993 is evident.

In November 1998, Armco personnel observed deterioration of the dike located around SWMU 12. Armco and BMWCI personnel performed an engineering evaluation of the dike failure. A slope failure occurred on the southern portion of the dike, directly north of the relocated Rock Creek and the Independence Sewage Treatment Plant outfall location. The failure was approximately 140 feet long and extended back into the bank approximately 40 feet from the toe of the slope at its deepest point. It appeared that the failure was a result of extensive erosion on the supporting toe of the slope and scouring of the dike due to Rock Creek flow combined with discharge from the Sewage Plant outfall. Based on the site evaluation, it did not appear that contents of the SWMU have been released due to this condition. USEPA was notified of these conditions in Armco's Fourth Quarter 1998 Progress Report dated January 11, 1999.

Based on the types of materials handled at SWMU 12 and previous sampling and analysis activities completed by Amoco, the primary constituents of potential concern were those associated with petroleum refining waste: chromium (both trivalent and hexavalent), lead, VOCs, and SVOCs.

SWMU 12 was designated in the Permit as an IM SWMU. IM activities were completed as described in Section 14.2.

#### **14.1.2 Release Potential**

Management practices associated with SWMU 12 involved direct contact with surface water and surface soil within the dike boundaries. The primary release potential for SWMU 12 was to the surrounding surface soil, subsurface soil, and groundwater.

### **14.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of surface soil, subsurface soil, and groundwater samples. Table 14-1 presents a summary of the investigation activities completed for SWMU 12, and Figure 14-1 presents the sampling and monitoring well locations.

#### **14.2.1 Interim Measures Activities**

Four additional monitoring wells (Monitoring Wells 12MW1 through 12MW4) were installed at SWMU 12 to supplement existing Monitoring Wells OWA5 and OWA6. Groundwater samples were collected from each of the six monitoring wells and analyzed for TPH, dissolved lead, dissolved chromium (trivalent and hexavalent), and Skinner's List of VOCs and SVOCs.

Subsurface soil samples from three depth intervals were collected from Monitoring Well Borings 12MW1 and 12MW3 to determine the general physical and chemical characteristics of the subsurface materials at SWMU 12. To differentiate these types of samples from those associated with contaminant characterization, these analyses are typically referred to as physical analyses

(see Subsection 2.5.2.2). Results for the physical analyses were presented in Appendix G of the *Interim Measures Investigation Report* (BMWCI, 1997a), and Appendix D of this Report.

Subsurface soil for chemical analysis was collected from monitoring well borings where signs of soil contamination (organic odors and/or elevated PID readings) were present. Subsurface soil samples were collected from two depth intervals each in Monitoring Well Borings 12MW3 and 12MW4. Subsurface soil samples were analyzed for TPH, lead, chromium (trivalent and hexavalent), and Skinner's List of VOCs and SVOCs.

#### **14.2.2 RFI Activities**

To further define the nature and extent of soil contamination at SWMU 12, surface soil samples were collected during RFI Phase 1 from four grids (Grids 12G01 through 12G04), and were composites of five aliquot locations from within each grid. Due to the presence of approximately 6 inches of silt from the 1993 flood, surface soil samples were collected from 6 to 12 inches bgs to obtain soil containing representative landfarmed materials. Surface soil samples were analyzed for Skinner's List of SVOCs, chromium (hexavalent and trivalent), lead, and TPH.

Three direct-push soil borings (Borings 12B01 through 12B03) were placed in the center of surface soil grids 12G01, 12G02, and 12G03, and samples were collected from two depth intervals (0 to 4 feet and 4 to 7 feet bgs). Subsurface soil samples were analyzed for Skinner's List of VOCs and SVOCs, chromium (hexavalent, trivalent, and total), lead, and TPH.

Four soil borings completed as monitoring wells at the former Amoco Landfarm (SWMU 12) during the RFI penetrated through the alluvial sediments to bedrock. Depth to bedrock at SWMU 12 ranges from 25 to 50 feet bgs. The SWMU 12 subsurface is characterized by clays and silts to a depth of 15 to 25 feet bgs where there is a transition to fine sand. Below 30 to 35 feet, fine sand is replaced by coarser sands and gravels. Depth to groundwater at SWMU 12 ranges from 17 to 26 feet bgs although subtracting the height of the slag berm upon which the wells are located, the actual depth to groundwater from undisturbed ground surface is probably



13 to 14 feet bgs. Bedrock topography appears to exert strong influence on groundwater flow patterns and gradients.

### **14.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Tables 14-2 through 14-4 present the soil analytical results for SWMU 12. Figures 14-2 through 14-4 present the soil analytical results for lead, Skinner's List of VOCs, and Skinner's List of SVOCs, respectively. TPH results are presented in Appendix U.

#### **14.3.1 Metals**

Hexavalent chromium was not detected in any of the soil samples collected at SWMU 12. Trivalent chromium was detected in all of the samples collected from SWMU 12. Trivalent chromium results were highest in the surface soil samples, and the highest concentration (1,330 mg/Kg) was detected in the sample collected from Grid 12G03 inside the dike. Trivalent chromium concentrations decreased with increasing depth. In the samples collected from the 4 to 7 feet bgs interval, trivalent chromium concentrations ranged from 19.2 mg/Kg to 76.4 mg/Kg, and in the deepest sampling interval (12MW3, 19 to 21 feet bgs), the trivalent chromium concentration was 14.6 mg/Kg. No 20 DAF SSL exists for trivalent chromium. Therefore, the vertical and horizontal extent of hexavalent and trivalent chromium in soil were adequately defined by the sampling locations.

Figure 14-2 presents the soil analytical results for lead. Lead was detected in all of the soil samples except the subsurface soil sample collected from the 15 to 16 feet bgs sampling interval at Well 12MW4. The highest lead concentrations (up to 6,080 DJ\* mg/Kg) were found in the surface soil grids located inside the dike, and the lowest detected concentrations were found in the deepest soil boring samples (18.6 mg/Kg at 12MW3, 19 to 21 feet bgs). Lead concentrations decreased with increasing depth. Lead exceeded the 20 DAF SSL (400 mg/Kg) in samples collected from each of the surface grids inside the dike. However, lead concentrations were below the 20 DAF SSL in the surface soil sample collected outside of the dike near the culvert outfall. Therefore, the horizontal extent of lead was well defined by the dike. The vertical extent of lead exceedences of the 20 DAF SSL was limited to the upper 4 feet of soil. Table 14-6

shows the soil results that exceeded screening limits for SWMU 12. Since surface soil samples were collected below a 6-inch layer of silt from the 1993 flood, surface soil results are not indicative of metal concentrations at the ground surface.

#### **14.3.2 VOCs**

Ten subsurface soil samples were analyzed for Skinner's List of VOCs. VOCs were not detected in any of the soil samples collected at SWMU 12. As shown on Figure 14-3, the vertical and horizontal extent of VOCs in soil was adequately defined by the sampling locations.

#### **14.3.3 SVOCs**

Four surface soil and ten subsurface soil samples were collected and analyzed for Skinner's List of SVOCs. Since surface soil samples were collected below a 6-inch layer of silt from the 1993 flood, surface soil results are not indicative of SVOC concentrations at the ground surface. Figure 14-4 presents the Total SVOC results for the soil samples. Surface soil concentrations of Total SVOCs ranged from 27,800  $\mu\text{g/Kg}$  to 79,640  $\mu\text{g/Kg}$  inside the dike and were nondetect outside of the dike. SVOC concentrations were highest in the surface soil samples, and Total SVOC concentrations decreased with increasing depth. In the 4 to 7 feet bgs sampling interval, Total SVOC concentrations were non-detect except at Boring 12B03 (387  $\mu\text{g/Kg}$ ). SVOCs were not detected in any sample collected from greater than 8 feet bgs.

PAHs were the only SVOCs detected. Table 14-6 presents the soil samples with SVOC results that exceeded the 20 DAF SSLs. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were the only SVOCs with detections above their 20 DAF SSLs (2,000, 8,000, 5,000, and 2,000  $\mu\text{g/Kg}$ , respectively); the highest concentrations of these compounds were 6,740, 14,200, 15,700, and 17,300  $\mu\text{g/Kg}$ , respectively. All exceedences were limited to surface soil samples collected within the dike boundary, and SVOCs were not detected in the surface soil sample collected outside of the dike near the culvert outfall. Therefore, the vertical and horizontal extent of SVOCs in soil was adequately characterized at SWMU 12.

#### **14.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

A limited amount of information concerning the nature and extent of contamination in groundwater at SWMU 12 was available at the onset of the RFI. Two monitoring wells, OWA-5 and OWA-6, believed to have been installed in 1980, still exist at SWMU 12. Groundwater data had been collected from these wells on various historic occasions including June 3, 1980, August 26, 1980, and October 14, 1994. Data associated with these sampling events was provided in Appendix A of the RFI Workplan (BMWCI, 1996a). Total chromium, lead, and Skinner's List of VOCs and SVOCs were not detected in the October 1994 groundwater samples.

Table 14-5 presents the analytical results for the groundwater samples collected at SWMU 12 during IM. Figures 14-5 and 14-6 present the analytical results for dissolved metals and Skinner's List of VOCs and SVOCs, respectively. TPH results are presented in Appendix U.

##### **14.4.1 Dissolved Metals**

Groundwater samples were collected from six wells during IM. As shown on Figure 14-5, none of the samples contained detections of dissolved chromium, dissolved hexavalent chromium, dissolved trivalent chromium, or dissolved lead. Therefore, none of the groundwater screening MCLs for these metals were exceeded, and the nature and extent of dissolved metals in groundwater at SWMU 12 was adequately characterized by the sampling locations.

##### **14.4.2 VOCs**

As shown in Figure 14-6, compounds on Skinner's List of VOCs were not detected in the groundwater samples collected at SWMU 12. Therefore, the nature and extent of VOCs in groundwater was adequately characterized by the sampling locations.

##### **14.4.3 SVOCs**

The common laboratory contaminant bis(2-ethylhexyl)phthalate (BEHP) was detected in groundwater samples collected from Wells 12MW1 (26.5 µg/L) and 12MW3 (4 J µg/L). As shown on Table 14-7, BEHP results slightly exceeded the MCL (6 µg/L) for the sample collected

from Well 12MW1. BEHP was the only compound on the Skinner's List of SVOCs that was detected in the monitoring well samples. The nature and extent of SVOCs in groundwater was adequately characterized by the remaining sampling locations.

#### **14.5 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 12, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater and groundwater transport), the surface pathway (storm water runoff), and the air pathway (airborne dust).

The nature and extent of contamination at SWMU 12 was assessed through the collection of surface soil, subsurface soil, and groundwater samples. In soil, lead and PAHs exceeded 20 DAF SSLs to depths of 4 feet bgs (approximate deepest elevation 724 ft above MSL) and 1 foot bgs (approximate deepest elevation 727 ft above MSL), respectively. Therefore, soil transfer to groundwater could occur. The tendency for metals and PAHs to strongly adsorb to soil is expected to limit vertical migration.

Groundwater samples did not have detections of dissolved metals or PAHs. One other SVOC (BEHP) was detected at a concentration exceeding the MCL and surrounding groundwater samples contained non-detections or low concentrations (below the MCL). The saturated zone is typically encountered at approximate elevations ranging from 714 to 718 feet above MSL. Based on the vertical definition of subsurface soil constituents at depths shallower than the saturated zone and the limited detections in the groundwater, the groundwater transport pathway is not expected to be significant for SWMU 12. Groundwater flow direction at SWMU 12 is influenced by Rock Creek (adjacent to the south side of the SWMU) and the Blue River (approximately 1200 feet north of the SWMU).

SWMU 12 is a vegetated area. Storm water received within the diked area of the SWMU ponds and infiltrates. The culverts at the east side of the SWMU are kept closed; therefore, storm water runoff is not expected to travel outside of the diked area. Based on these factors, storm water runoff should not provide a significant route for constituent migration. Surface soil particulate

(dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. However, based on the dike surrounding the SWMU (which is expected to trap some airborne dust), the vegetative cover, and a 6-inch silt layer from the 1993 flood, airborne dust transport is not expected to be significant at SWMU 12.

## **14.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted for SWMU 12.

### **14.6.1 Human Health Evaluation**

SVOCs and lead were identified as COPCs in both surface and subsurface soil. BEHP was identified as a COPC in groundwater. A HHRA and lead modeling were conducted for SWMU 12 to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant noncarcinogenic health effects or carcinogenic risks posed by the chemicals of concern detected in soil or groundwater at SWMU 12. Assumptions and variables used in risk calculations are discussed in Chapter 4.0 of Appendix X. Results of the risk characterization and lead modeling are presented in Chapter 5.0 of Appendix X.

### **14.6.2 Ecological Evaluation**

COPECs identified for SWMU 12 included PAHs, trivalent chromium, and lead. The majority of the benchmarks were exceeded during the preliminary screening for the COPECs. During the site-specific screening, chromium (total and trivalent) was the only COPEC detected at concentrations that exceeded the soil nematodes and small mammal (rabbit and shrew) benchmarks. As such, chromium was the only chemical retained as a COPEC after the site-specific screening. No indications of metal toxicity were observed during the RFI field activities or the field site visit in October 1998. Since the pH of the soil is basic, chromium is probably not available to the ecological receptors inhabiting this area. Although chromium exceeded some of

the benchmarks, chromium is not expected to negatively impact the ecological community at SWMU 12. Details of the ecological risk evaluation for SWMU 12 are provided in Appendix Y.

#### 14.7 SUMMARY

SWMU 12, located in the eastern portion of the Facility, was utilized by Amoco for landfarming of petroleum refining waste. SWMU 12 covers an area of approximately 10 acres. Surface soil, subsurface soil, and groundwater samples were collected at SWMU 12 for metals (hexavalent chromium, trivalent chromium, and lead), VOCs (Skinner's List), and SVOCs (Skinner's List).

As shown on Figures 14-2 through 14-4, the horizontal and vertical extent of lead, hexavalent chromium, trivalent chromium, and Skinner's List of VOCs and SVOCs was adequately characterized in soil by the sampling locations at SWMU 12. Hexavalent chromium was not detected in any of the soil samples. Trivalent chromium was detected at concentrations up to 1,330 mg/Kg, and no 20 DAF SSL exists for trivalent chromium. Lead detections exceeded the 20 DAF SSL (400 mg/Kg) for six of the 14 surface and subsurface soil samples, at concentrations ranging up to 6,080 DJ\* mg/Kg. These exceedences were all contained within the SWMU 12 dike boundary and limited to the upper four feet of soil sampled. Lead results for the surface soil sample collected outside of the dike boundary near the culvert outfall were below the 20 DAF SSL. Therefore, the vertical and horizontal extent of lead detections was well defined by the sampling locations.

Skinner's List of VOCs were not detected in any of the soil samples collected at SWMU 12, and the vertical and horizontal extent of VOCs in soil was adequately defined by the sampling locations.

PAHs were the only Skinner's List of SVOCs detected. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were the only SVOCs with detections above their 20 DAF SSLs (2,000, 8,000, 5,000, and 2,000 µg/Kg, respectively); the highest concentrations of these compounds were 6,740, 14,200, 15,700, and 17,300 µg/Kg, respectively, in samples collected from Grid 12G01. All detections were limited to surface soil samples

collected within the dike boundary below the 6-inch layer of silt. No 20 DAF SSL exceedences were noted in samples collected from the 4 to 7 feet bgs depth interval. Therefore, the vertical and horizontal extent of SVOCs in soil was adequately characterized at SWMU 12.

Groundwater analytical results are presented on Figures 14-5 (dissolved lead, dissolved trivalent chromium, dissolved hexavalent chromium) and 14-6 (Skinner's List of VOCs and SVOCs). Six groundwater samples were collected from the monitoring wells located around SWMU 12. The common laboratory contaminant BEHP was the only SVOC detected, and was detected above the groundwater screening MCL (6 µg/L) in the sample from Well 12MW1 (26.5 µg/L). Dissolved metals and VOCs were not detected. Therefore, the nature and extent of dissolved metals, VOCs, and SVOCs in groundwater at SWMU 12 was adequately characterized by the sampling locations.

Potential migration pathways at SWMU 12 include soil transfer to groundwater, groundwater transport, storm water runoff, and airborne dust migration. Soil detections of lead and PAHs exceeded the 20 DAF SSLs (based on soil migration to groundwater), thus indicating that soil transfer to groundwater could occur. The tendency for metals and PAHs to strongly adsorb to soil is expected to limit vertical migration. Groundwater samples collected from the saturated zone showed non-detections of dissolved metals and PAHs, and one detection of another SVOC (BEHP) exceeding MCL. Based on the vertical definition of subsurface soil contamination at depths shallower than the saturated zone and the limited detections in the groundwater, the groundwater transport pathway is not expected to be significant for SWMU 12.

Storm water received within the diked area of the SWMU ponds and infiltrates, and culverts at the east side of the SWMU are kept closed. Therefore, storm water runoff is not expected to travel outside of the diked area and storm water runoff should not provide a significant route for contaminant migration. Surface soil particulate (dust) could become airborne. However, based on the dike surrounding the SWMU (which is expected to trap some airborne dust) and the vegetative cover, airborne dust transport is not expected to be significant at SWMU 12.



A risk evaluation was conducted for SWMU 12. For the human health evaluation, lead and PAHs were identified as COPCs in surface and subsurface soil, and BEHP was identified as a COPC in groundwater. Therefore, a HHRA and lead modeling were conducted to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil or groundwater at SWMU 12 for these exposure scenarios. An ecological evaluation was also conducted for SWMU 12. Chromium, lead, and PAHs exceeded preliminary (benchmark) screening, and chromium exceeded site-specific screening for various wildlife receptors. Qualitative factors and field site visits both indicate that chromium in soil is not eliciting adverse effects on these receptors, and as such, risk to potential ecological receptors is not expected to be significant.

\* \* \* \* \*

**Table 14-1**  
**SWMU 12 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis						Physical Analysis	Comments	Lab ID Number
Point	Designator				Lead	Skinner's		TPH	Chromium				
						VOC	SVOC		III	VI			
COMPOSITE SURFACE SOIL GRIDS													
12G01	SR1	0.5 - 1	03/10/1997	1	X		X	X	X	X		Field Duplicate	D97-2852-1
	SR1D	0.5 - 1	03/10/1997	1	X		X	X	X	X			D97-2852-2
12G02	SR1	0.5 - 1	03/10/1997	1	X		X	X	X	X			D97-2852-3
12G03	SR1	0.5 - 1	03/10/1997	1	X		X	X	X	X		Rinsate	D97-2852-4
	SR1R		03/10/1997	1	X		X	X	X	X			D97-2852-5
12G04	SR1	0.5 - 1	03/10/1997	1	X		X	X	X	X		Matrix Spike Matrix Spike Duplicate	D97-2852-6
	SR1MS	0.5 - 1	03/10/1997	1	X		X		X	X			D97-2852-7
	SR1MSD	0.5 - 1	03/10/1997	1	X		X		X	X			D97-2852-8
INTERIM MEASURES SOIL BORING SAMPLES													
12MW1	ST1	5 - 7	12/06/1996	IM							X		
	SS1	18 - 20	12/06/1996	IM							X		
	SS2	25 - 26	12/06/1996	IM							X		
12MW3	CS1	14 - 19	12/06/1996	IM	X	X	X	X	X	X			D96-14052-3
	SS1	19 - 21	12/06/1996	IM	X	X	X	X	X	X			D96-14052-4
	ST1	4 - 6	12/06/1996	IM							X		
	ST2	8 - 10	12/06/1996	IM							X		
	CS1	14 - 19	12/06/1996	IM							X		
12MW4	CS1	7 - 7.5	12/06/1996	IM	X	X	X	X	X	X			D96-14052-1
	CS2	15 - 16	12/06/1996	IM	X	X	X	X	X	X			D96-14052-2
DIRECT-PUSH SOIL SAMPLES													
12B01	DP1	0 - 4	03/17/1997	1	X	X	X	X	X	X		Field Duplicate	D97-3170-1
	DP1D	0 - 4	03/17/1997	1	X	X	X	X	X	X			D97-3170-2
	DP2	4 - 7	03/17/1997	1	X	X	X	X	X	X			D97-3170-3
12B02	DP1	0 - 4	03/17/1997	1	X	X	X	X	X	X		Matrix Spike Matrix Spike Duplicate	D97-3170-4
	DP2	4 - 7	03/17/1997	1	X	X	X	X	X	X			D97-3170-5
	DP2MS	4 - 7	03/17/1997	1	X	X	X		X	X			D97-3170-6
	DP2MSD	4 - 7	03/17/1997	1	X	X	X		X	X			D97-3170-7
12B03	DP1	0 - 4	03/17/1997	1	X	X	X	X	X	X		Rinsate	D97-3170-8
	DP2	4 - 7	03/17/1997	1	X	X	X	X	X	X			D97-3170-9
	DP2R		03/17/1997	1	X	X	X	X	X	X			D97-3170-10

**Table 14-1**  
**SWMU 12 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis						Physical Analysis	Comments	Lab ID Number
Point	Designator				Skinner's		TPH	Chromium					
		Lead	VOC	SVOC	III	VI							
INTERIM MEASURES GROUNDWATER SAMPLES													
12MW1	GW1	NA	12/11/1996	IM	X	X	X	X	X	X	Matrix Spike Matrix Spike Duplicate	D96-14212-2	
	GW1MS	NA	12/11/1996	IM	X	X	X		X	X		D96-14212-5	
	GW1MSD	NA	12/11/1996	IM	X	X	X		X	X		D96-14212-6	
12MW2	GW1	NA	12/11/1996	IM	X	X	X	X	X	X		D96-14212-3	
12MW3	GW1	NA	12/11/1996	IM	X	X	X	X	X	X		D96-14212-4	
12MW4	GW1	NA	12/11/1996	IM	X	X	X	X	X	X	Field Duplicate	D96-14212-7	
	GW1D	NA	12/11/1996	IM	X	X	X	X	X	X		D96-14212-8	
OWA5	GW1	NA	12/11/1996	IM	X	X	X	X	X	X		D96-14212-9	
OWA6	GW1	NA	12/11/1996	IM	X	X	X	X	X	X		D96-14212-10	

**Notes:**

ft = feet

IM = Interim Measures

SVOC = Semivolatile Organic Compounds

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

**Table 14-2**  
**SWMU 12 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		12G01/SR1 3/10/97 0.5 1 D97-2852-1	12G01/SR1D 3/10/97 0.5 1 D97-2852-2 Duplicate	12G02/SR1 3/10/97 0.5 1 D97-2852-3	12G03/SR1 3/10/97 0.5 1 D97-2852-4	12G04/SR1 3/10/97 0.5 1 D97-2852-6
Semivolatiles	UNITS					
1-Methylnaphthalene	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
2,4-Dimethylphenol	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
2,4-Dinitrophenol	ug/Kg	27,200 U	27,100 U	27,200 U	27,900 U	4,340 U
4-Nitrophenol	ug/Kg	27,200 U	27,100 U	27,200 U	27,900 U	4,340 U
7,12-Dimethylbenz(a)anthracene	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Anthracene	ug/Kg	1,190 J	5,420 U	5,450 U	5,590 U	868 U
Benzo(a)anthracene	ug/Kg	6,740	3,700 J	5,450 U	5,590 U	868 U
Benzo(a)pyrene	ug/Kg	5,440 U	14,200	7,590	11,700	868 U
Benzo(b)fluoranthene	ug/Kg	15,700	8,590	5,560	9,270	868 U
Benzo(k)fluoranthene	ug/Kg	3,790 J	5,420 U	5,450 U	3,510 J	868 U
Bis(2-ethylhexyl)phthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Butylbenzylphthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Chrysene	ug/Kg	22,900	12,800	5,450 U	11,600	868 U
Di-n-butylphthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Di-n-octylphthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Dibenz(a,h)acridine	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Dibenzo(a,h)anthracene	ug/Kg	17,300	13,000	7,810	11,800	868 U
Dichlorobenzenes	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Diethyl phthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Dimethyl phthalate	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Fluoranthene	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Indene	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Methylchrysene	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Methylphenols	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Naphthalene	ug/Kg	8,860	6,970	3,870 J	5,290 J	868 U
Phenanthrene	ug/Kg	3,160 J	2,260 J	5,450 U	1,510 J	868 U
Phenol	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Pyrene	ug/kg	5,440 U	5,210 J	2,970 J	1,500 J	868 U
Pyridine	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Quinoline	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Thiophenol (Benzenethiol)	ug/Kg	5,440 U	5,420 U	5,450 U	5,590 U	868 U
Total Detected SVOCs	UNITS					
Total Semi-Volatiles	ug/Kg	79,640	66,730	27,800	56,180	ND
Metals, Total	UNITS					
Chromium, Hexavalent	mg/Kg	0.14 U	0.14 U	0.14 U	0.14 U	0.13 U
Chromium, Total	mg/Kg	1,290	1,260	1,290	1,330	30.8
Chromium, Trivalent	mg/Kg	1,290	1,260	1,290	1,330	30.8
Lead, Total	mg/Kg	5,480 DJ*	5,340 DJ*	5,610 DJ*	6,080 DJ*	83.8 J*

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J\* - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-3**  
**SWMU 12 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point:		12MW3/CS1	12MW3/SS1	12MW4/CS1	12MW4/CS2
Date Sampled:		12/6/1996	12/6/1996	12/6/1996	12/6/1996
Sample Depth From:		14	19	7	15
Sample Depth To:		19	21	7.5	16
Laboratory Number:		D96-14052-3	D96-14052-4	D96-14052-1	D96-14052-2
Sample Type:					
<b>Volatiles</b>	<b>UNITS</b>				
1,2-Dibromoethane	ug/Kg	13.7 U	13 U	13.2 U	13 U
1,2-Dichloroethane	ug/Kg	13.7 U	13 U	13.2 U	13 U
1,4-Dioxane	ug/Kg	13.7 U	13 U	13.2 U	13 U
2-Butanone	ug/Kg	13.7 U	13 U	13.2 U	13 U
Benzene	ug/Kg	13.7 U	13 U	13.2 U	13 U
Carbon disulfide	ug/Kg	13.7 U	13 U	13.2 U	13 U
Chlorobenzene	ug/Kg	13.7 U	13 U	13.2 U	13 U
Chloroform	ug/Kg	13.7 U	13 U	13.2 U	13 U
Ethylbenzene	ug/Kg	13.7 U	13 U	13.2 U	13 U
Styrene	ug/Kg	13.7 U	13 U	13.2 U	13 U
Toluene	ug/Kg	13.7 U	13 U	13.2 U	13 U
Xylenes (total)	ug/Kg	13.7 U	13 U	13.2 U	13 U
<b>Semivolatiles</b>	<b>UNITS</b>				
1-Methylnaphthalene	ug/Kg	907 U	857 U	868 U	856 U
2,4-Dimethylphenol	ug/Kg	907 U	857 U	868 U	856 U
2,4-Dinitrophenol	ug/Kg	4,530 U	4,290 U	4,340 U	4,280 U
4-Nitrophenol	ug/Kg	4,530 U	4,290 U	4,340 U	4,280 U
7,12-Dimethylbenz(a)anthracene	ug/Kg	907 U	857 U	868 U	856 U
Anthracene	ug/Kg	907 U	857 U	868 U	856 U
Benzo(a)anthracene	ug/Kg	907 U	857 U	868 U	856 U
Benzo(a)pyrene	ug/Kg	907 U	857 U	868 U	856 U
Benzo(b)fluoranthene	ug/Kg	907 U	857 U	868 U	856 U
Benzo(k)fluoranthene	ug/Kg	907 U	857 U	868 U	856 U
Bis(2-ethylhexyl)phthalate	ug/Kg	907 U	857 U	868 U	856 U
Butylbenzylphthalate	ug/Kg	907 U	857 U	868 U	856 U
Chrysene	ug/Kg	907 U	857 U	868 U	856 U
Di-n-butylphthalate	ug/Kg	907 U	857 U	868 U	856 U
Di-n-octylphthalate	ug/Kg	907 U	857 U	868 U	856 U
Dibenz(a,h)acridine	ug/Kg	907 U	857 U	868 U	856 U
Dibenzo(a,h)anthracene	ug/Kg	907 U	857 U	868 U	856 U
Dichlorobenzenes	ug/Kg	907 U	857 U	868 U	856 U
Diethyl phthalate	ug/Kg	907 U	857 U	868 U	856 U
Dimethyl phthalate	ug/Kg	907 U	857 U	868 U	856 U
Fluoranthene	ug/Kg	907 U	857 U	868 U	856 U
Indene	ug/Kg	907 U	857 U	868 U	856 U
Methylchrysene	ug/Kg	907 U	857 U	868 U	856 U
Methylphenols	ug/Kg	907 U	857 U	868 U	856 U
Naphthalene	ug/Kg	907 U	857 U	868 U	856 U
Phenanthrene	ug/Kg	907 U	857 U	868 U	856 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
ND - Not Detected

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-3**  
**SWMU 12 Interim Measures Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point:		12MW3/CS1	12MW3/SS1	12MW4/CS1	12MW4/CS2
Date Sampled:		12/6/1996	12/6/1996	12/6/1996	12/6/1996
Sample Depth From:		14	19	7	15
Sample Depth To:		19	21	7.5	16
Laboratory Number:		D96-14052-3	D96-14052-4	D96-14052-1	D96-14052-2
Sample Type:					
<b>Semivolatiles</b>	<b>UNITS</b>				
<b>- CONTINUED -</b>					
Phenol	ug/Kg	907 U	857 U	868 U	856 U
Pyrene	ug/kg	907 U	857 U	868 U	856 U
Pyridine	ug/Kg	907 U	857 U	868 U	856 U
Quinoline	ug/Kg	907 U	857 U	868 U	856 U
Thiophenol (Benzenthionol)	ug/Kg	907 U	857 U	868 U	856 U
<b>Metals, Total</b>	<b>UNITS</b>				
Chromium, Hexavalent	mg/Kg	0.14 U	0.13 U	0.13 U	0.13 U
Chromium, Total	mg/Kg	9.51	14.6	19.3	11.2
Chromium, Trivalent	mg/Kg	9.51	14.6	19.3	11.2
Lead, Total	mg/Kg	18.9	18.6	26	13 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
ND - Not Detected

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-4**  
**SWMU 12 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		12B01/DP1 3/17/1997 0 4 D97-3170-1	12B01/DP1 3/17/1997 0 4 D97-3170-1R2 Reanalysis	12B01/DP1D 3/17/1997 0 4 D97-3170-2 Duplicate	12B01/DP1D 3/17/1997 0 4 D97-3170-2R2 Duplicate Reanalysis	12B01/DP2 3/17/1997 4 7 D97-3170-3	12B02/DP1 3/17/1997 0 4 D97-3170-4	12B02/DP1 3/17/1997 0 4 D97-3170-4R2 Reanalysis
<b>Volatiles</b>	<b>UNITS</b>							
1,2-Dibromoethane	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
1,2-Dichloroethane	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
1,4-Dioxane	ug/Kg	134 U	NA	135 U	NA	132 U	131 U	NA
2-Butanone	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Benzene	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Carbon disulfide	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Chlorobenzene	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Chloroform	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Ethylbenzene	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Styrene	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Toluene	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
Xylenes (total)	ug/Kg	6.7 U	NA	6.8 U	NA	6.6 U	6.5 U	NA
<b>Semivolatiles</b>	<b>UNITS</b>							
1-Methylnaphthalene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
2,4-Dimethylphenol	ug/Kg	5,290 U	NA	5,350 U	53,500 DU	871 U	863 U	8,630 DU
2,4-Dinitrophenol	ug/Kg	26,400 U	NA	26,800 U	268,000 DU	4,350 U	4,310 U	43,100 DU
4-Nitrophenol	ug/Kg	26,400 U	NA	26,800 U	268,000 DU	4,350 U	4,310 U	43,100 DU
7,12-Dimethylbenz(a)anthracene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Anthracene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Benzo(a)anthracene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Benzo(a)pyrene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Benzo(b)fluoranthene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	409 J	8,630 DU
Benzo(k)fluoranthene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	277 J	8,630 DU
Bis(2-ethylhexyl)phthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Butylbenzylphthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Chrysene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Di-n-butylphthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Di-n-octylphthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Dibenz(a,h)acridine	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Dibenzo(a,h)anthracene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	222 J	8,630 DU
Dichlorobenzenes	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Diethyl phthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Dimethyl phthalate	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Fluoranthene	ug/Kg	5,290 U	52,900 DU	4,220 J	53,500 DU	871 U	863 U	8,630 DU
Indene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Methylchrysene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Methylphenols	ug/Kg	5,290 U	NA	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Naphthalene	ug/Kg	3,060 J	52,900 DU	3,070 J	53,500 DU	871 U	298 J	8,630 DU

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted For Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 14-4**  
**SWMU 12 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		12B01/DP1 3/17/1997 0 4 D97-3170-1	12B01/DP1 3/17/1997 0 4 D97-3170-1R2 Reanalysis	12B01/DP1D 3/17/1997 0 4 D97-3170-2 Duplicate	12B01/DP1D 3/17/1997 0 4 D97-3170-2R2 Duplicate Reanalysis	12B01/DP2 3/17/1997 4 7 D97-3170-3	12B02/DP1 3/17/1997 0 4 D97-3170-4	12B02/DP1 3/17/1997 0 4 D97-3170-4R2 Reanalysis
<b>Semivolatiles</b>	<b>UNITS</b>							
<b>- CONTINUED -</b>								
Phenanthrene	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Phenol	ug/Kg	5,290 U	NA	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Pyrene	ug/kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Pyridine	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Quinoline	ug/Kg	5,290 U	52,900 DU	5,350 U	53,500 DU	871 U	863 U	8,630 DU
Thiophenol (Benzenthio)	ug/Kg	5,290 U	NA	5,350 U	53,500 DU	871 U	863 U	8,630 DU
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>ug/Kg</b>	<b>3,060</b>	<b>ND</b>	<b>7,290</b>	<b>ND</b>	<b>ND</b>	<b>1,206</b>	<b>ND</b>
<b>Metals, Total</b>	<b>UNITS</b>							
Chromium, Hexavalent	mg/Kg	0.13 U	NA	0.14 U	NA	0.13 U	0.13 U	NA
Chromium, Total	mg/Kg	203	NA	217	NA	19.5	424	NA
Chromium, Trivalent	mg/Kg	203	NA	217	NA	19.5	424	NA
Lead, Total	mg/Kg	774	NA	779	NA	32.8	1,840	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted For Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-4**  
**SWMU 12 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		12B02/DP2 3/17/1997 4 7 D97-3170-5	12B03/DP1 3/17/1997 0 4 D97-3170-8	12B03/DP1 3/17/1997 0 4 D97-3170-8R2 Reanalysis	12B03/DP2 3/17/1997 4 7 D97-3170-9	12B03/DP2 3/17/1997 4 7 D97-3170-9R2 Reanalysis
<b>Volatiles</b>	<b>UNITS</b>					
1,2-Dibromoethane	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
1,2-Dichloroethane	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
1,4-Dioxane	ug/Kg	135 U	129 U	NA	130 U	NA
2-Butanone	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Benzene	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Carbon disulfide	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Chlorobenzene	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Chloroform	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Ethylbenzene	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Styrene	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Toluene	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
Xylenes (total)	ug/Kg	6.7 U	6.4 U	NA	6.5 U	NA
<b>Semivolatiles</b>	<b>UNITS</b>					
1-Methylnaphthalene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
2,4-Dimethylphenol	ug/Kg	891 U	5,090 U	NA	860 U	8,600 DU
2,4-Dinitrophenol	ug/Kg	4,450 U	25,400 U	NA	4,300 U	43,000 DU
4-Nitrophenol	ug/Kg	4,450 U	25,400 U	NA	4,300 U	43,000 DU
7,12-Dimethylbenz(a)anthracene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Anthracene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Benzo(a)anthracene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Benzo(a)pyrene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Benzo(b)fluoranthene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Benzo(k)fluoranthene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Bis(2-ethylhexyl)phthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Butylbenzylphthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Chrysene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Di-n-butylphthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Di-n-octylphthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Dibenz(a,h)acridine	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Dibenzo(a,h)anthracene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Dichlorobenzenes	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Diethyl phthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Dimethyl phthalate	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Fluoranthene	ug/Kg	891 U	2,530 J	50,900 DU	387 J	8,600 DU
Indene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Methylchrysene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Methylphenols	ug/Kg	891 U	5,090 U	NA	860 U	8,600 DU
Naphthalene	ug/Kg	891 U	1,490 J	50,900 DU	860 U	8,600 DU

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted For Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-4**  
**SWMU 12 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		12B02/DP2	12B03/DP1	12B03/DP1	12B03/DP2	12B03/DP2
Date Sampled:		3/17/1997	3/17/1997	3/17/1997	3/17/1997	3/17/1997
Sample Depth From:		4	0	0	4	4
Sample Depth To:		7	4	4	7	7
Laboratory Number:		D97-3170-5	D97-3170-8	D97-3170-8R2	D97-3170-9	D97-3170-9R2
Sample Type:				Reanalysis		Reanalysis
<b>Semivolatiles</b>	<b>UNITS</b>					
<b>- CONTINUED -</b>						
Phenanthrene	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Phenol	ug/Kg	891 U	5,090 U	NA	860 U	8,600 DU
Pyrene	ug/kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Pyridine	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Quinoline	ug/Kg	891 U	5,090 U	50,900 DU	860 U	8,600 DU
Thiophenol (Benzenthionol)	ug/Kg	891 U	5,090 U	NA	860 U	8,600 DU
<b>Total Detected SVOCs</b>	<b>UNITS</b>					
Total Semi-Volatiles	ug/Kg	ND	4,020	ND	387	ND
<b>Metals, Total</b>	<b>UNITS</b>					
Chromium, Hexavalent	mg/Kg	0.13 U	0.13 U	NA	0.13 U	NA
Chromium, Total	mg/Kg	19.2	173	NA	76.4	NA
Chromium, Trivalent	mg/Kg	19.2	173	NA	76.4	NA
Lead, Total	mg/Kg	24.6	682	NA	303	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted For Analysis

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-5**  
**SWMU 12 Interim Measures Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		12MW1/GW1 12/11/1996 0 0 D96-14212-2	12MW2/GW1 12/11/1996 0 0 D96-14212-3	12MW3/GW1 12/11/1996 0 0 D96-14212-4	12MW4/GW1 12/11/1996 0 0 D96-14212-7	12MW4/GW1D 12/11/1996 0 0 D96-14212-8 Duplicate	OWA05/GW1 12/11/1996 0 0 D96-14212-9
<b>Volatiles</b>	<b>UNITS</b>						
1,2-Dibromoethane	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dioxane	ug/L	100 U	100 U	100 U	100 U	100 U	100 U
2-Butanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Xylenes (total)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
<b>Semivolatiles</b>	<b>UNITS</b>						
1-Methylnaphthalene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	ug/L	50 U	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	ug/L	50 U	50 U	50 U	50 U	50 U	50 U
7,12-Dimethylbenz(a)anthracene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	ug/L	26.5	10 U	4 J	10 U	10 U	10 U
Butylbenzylphthalate	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octylphthalate	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)acridine	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzo(a,h)anthracene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Dichlorobenzenes	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl phthalate	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Indene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Methylchrysene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Methylphenols	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-5**  
**SWMU 12 Interim Measures Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		12MW1/GW1	12MW2/GW1	12MW3/GW1	12MW4/GW1	12MW4/GW1D	OWA05/GW1
Date Sampled:		12/11/1996	12/11/1996	12/11/1996	12/11/1996	12/11/1996	12/11/1996
Sample Depth From:		0	0	0	0	0	0
Sample Depth To:		0	0	0	0	0	0
Laboratory Number:		D96-14212-2	D96-14212-3	D96-14212-4	D96-14212-7	D96-14212-8	D96-14212-9
Sample Type:						Duplicate	
<b>Semivolatiles</b>	<b>UNITS</b>						
<b>- CONTINUED -</b>							
Phenol	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Pyridine	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Quinoline	ug/L	10 U	10 U	10 U	10 U	10 U	10 U
Thiophenol (Benzenthionol)	ug/L	20 U	20 U	20 U	20 U	20 U	20 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>						
<b>Total Semi-Volatiles</b>	<b>ug/L</b>	<b>26.5</b>	<b>ND</b>	<b>4</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>
<b>Metals, Dissolved</b>	<b>UNITS</b>						
Chromium, Dissolved	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA
Chromium, Hexavalent	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Chromium, Trivalent	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Lead, Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-5**  
**SWMU 12 Interim Measures Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		OWA06/GW1	
Date Sampled:		12/11/1996	
Sample Depth From:		0	
Sample Depth To:		0	
Laboratory Number:		D96-14212-10	
Sample Type:			
<b>Volatiles</b>	<b>UNITS</b>		
1,2-Dibromoethane	ug/L	10	U
1,2-Dichloroethane	ug/L	10	U
1,4-Dioxane	ug/L	100	U
2-Butanone	ug/L	10	U
Benzene	ug/L	10	U
Carbon disulfide	ug/L	10	U
Chlorobenzene	ug/L	10	U
Chloroform	ug/L	10	U
Ethylbenzene	ug/L	10	U
Styrene	ug/L	10	U
Toluene	ug/L	10	U
Xylenes (total)	ug/L	10	U
<b>Semivolatiles</b>	<b>UNITS</b>		
1-Methylnaphthalene	ug/L	10	U
2,4-Dimethylphenol	ug/L	10	U
2,4-Dinitrophenol	ug/L	50	U
4-Nitrophenol	ug/L	50	U
7,12-Dimethylbenz(a)anthracene	ug/L	10	U
Anthracene	ug/L	10	U
Benzo(a)anthracene	ug/L	10	U
Benzo(a)pyrene	ug/L	10	U
Benzo(b)fluoranthene	ug/L	10	U
Benzo(k)fluoranthene	ug/L	10	U
Bis(2-ethylhexyl)phthalate	ug/L	10	U
Butylbenzylphthalate	ug/L	10	U
Chrysene	ug/L	10	U
Di-n-butylphthalate	ug/L	10	U
Di-n-octylphthalate	ug/L	10	U
Dibenz(a,h)acridine	ug/L	10	U
Dibenzo(a,h)anthracene	ug/L	10	U
Dichlorobenzenes	ug/L	10	U
Diethyl phthalate	ug/L	10	U
Dimethyl phthalate	ug/L	10	U
Fluoranthene	ug/L	10	U
Indene	ug/L	10	U
Methylchrysene	ug/L	10	U
Methylphenols	ug/L	10	U
Naphthalene	ug/L	10	U
Phenanthrene	ug/L	10	U

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
D - Diluted sample

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
NA - Not Analyzed

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 14-6**  
**SWMU 12 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result
<b>Skinner's Semivolatiles</b>	<b>(µg/kg)</b>			<b>(µg/kg)</b>
Benzo(a)anthracene	2000	12G01 / SR1 12G01 / SR1D	0.5 - 1 0.5 - 1	6740 3700 J
Benzo(a)pyrene	8000	12G01 / SR1D 12G03 / SR1	0.5 - 1 0.5 - 1	14200 11700
Benzo(b)fluoranthene	5000	12G01 / SR1 12G01 / SR1D 12G02 / SR1 12G03 / SR1	0.5 - 1 0.5 - 1 0.5 - 1 0.5 - 1	15700 8590 5560 9270
Dibenzo(a,h)anthracene	2000	12G01 / SR1 12G01 / SR1D 12G02 / SR1 12G03 / SR1	0.5 - 1 0.5 - 1 0.5 - 1 0.5 - 1	17300 13000 7810 11800
<b>Metals</b>	<b>(mg/kg)</b>			<b>(mg/kg)</b>
Lead, Total	400	12G01 / SR1 12G01 / SR1D 12G02 / SR1 12G03 / SR1 12B01 / DP1 12B01 / DP1D 12B02 / DP1 12B03 / DP1	0.5 - 1 0.5 - 1 0.5 - 1 0.5 - 1 0 - 4 0 - 4 0 - 4 0 - 4	5480 DJ* 5340 DJ* 5610 DJ* 6080 DJ* 774 779 1840 682

**Notes:**

- D = Sample was diluted prior to analysis.
- DAF = Dilution Attenuation Factor
- ft = feet
- J = Estimated value; concentration below practical quantitation limit.
- J\* = Qualified as estimated by BMWCI during the QC evaluation; matrix spike and/or matrix spike duplicate percent recoveries were below QC limits.
- SSL = Soil Screening Level



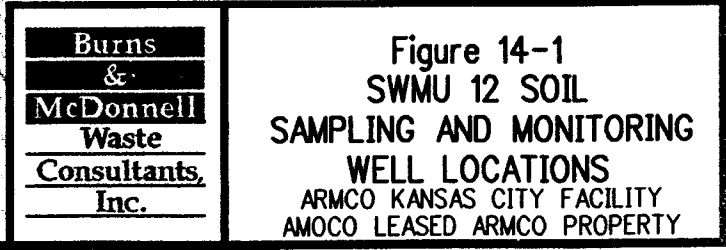
**Table 14-7**  
**SWMU 12 Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
Skinner's Semivolatiles	(µg/L)			(µg/L)
bis(2-ethylhexyl)phthalate	6	12MW1 / GW1	NA	26.5

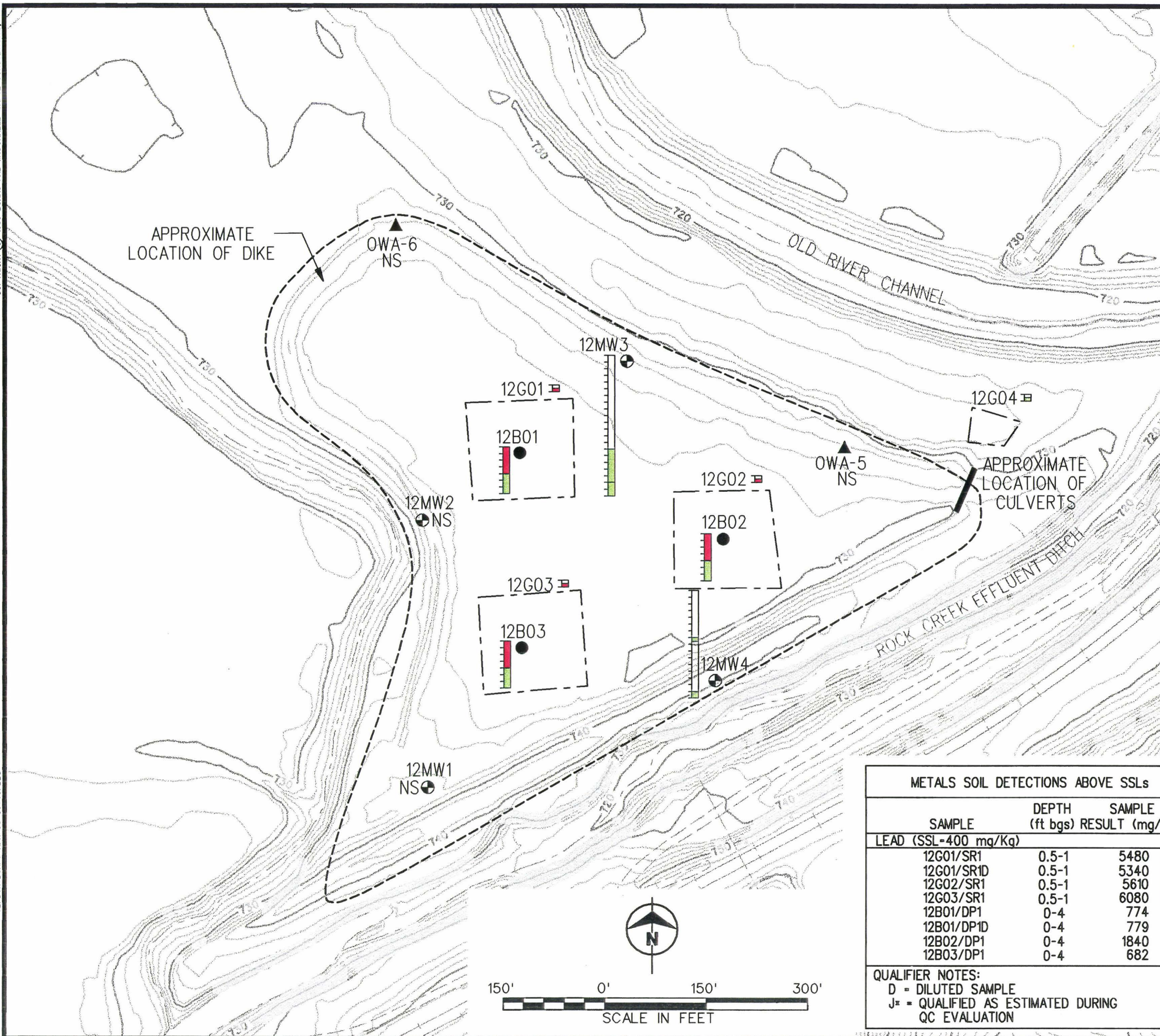
Notes:

ft = feet

MCL = Maximum Contaminant Level







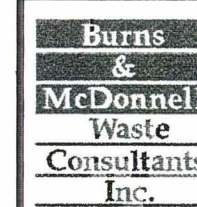
# **LEGEND**

- DIRECT-PUSH BORING LOCATION
- ⊕ RFI MONITORING WELL LOCATION
- ▲ PRE-EXISTING MONITORING WELL LOCATION
- LOCATION OF SURFACE SOIL SAMPLING GRID
- SWMU BOUNDARY
- + RAILROAD
- NS NOT SAMPLED
- █ LEAD RESULT (mg/Kg) ABOVE SSL (400 mg/Kg) (SEE INSET TABLE)
- █ LEAD RESULT (mg/Kg) BELOW SSL (400 mg/Kg)
- NO SAMPLE COLLECTED AT THIS DEPTH INTERVAL
- ▤ SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.

## **NOTES:**

1. COMPOSITE GRID SURFACE SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
2. DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
3. SOIL FROM MONITORING WELL INSTALLATION COLLECTED DURING RFI INTERIM MEASURES (1996).
4. SEE SWMU 12 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.

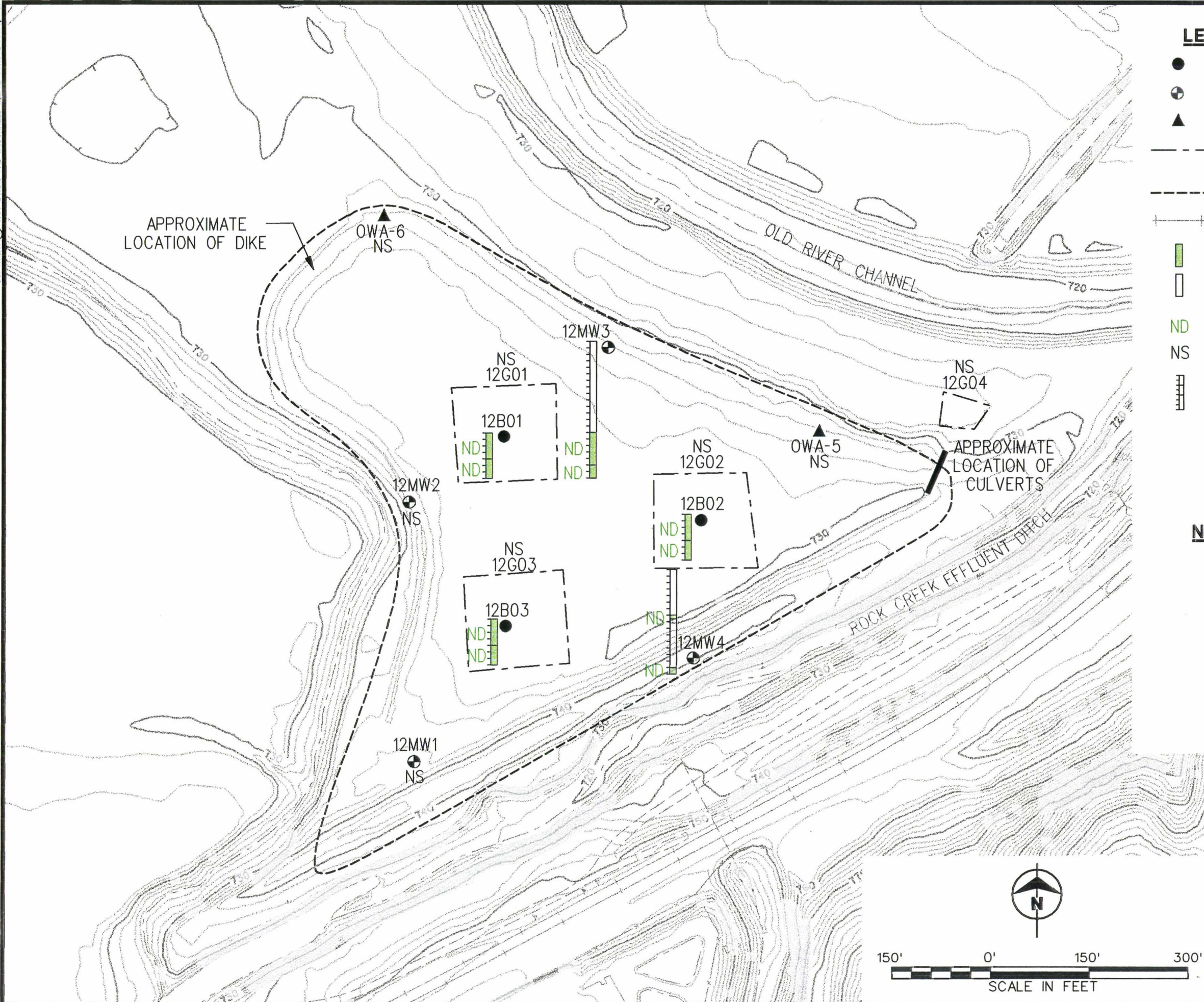
METALS SOIL DETECTIONS ABOVE SSLs			
SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (mg/Kg)	
LEAD (SSL=400 mg/Kg)			
12G01/SR1	0.5-1	5480	DJ*
12G01/SR1D	0.5-1	5340	DJ*
12G02/SR1	0.5-1	5610	DJ*
12G03/SR1	0.5-1	6080	DJ*
12B01/DP1	0-4	774	
12B01/DP1D	0-4	779	
12B02/DP1	0-4	1840	
12B03/DP1	0-4	682	
QUALIFIER NOTES:			
D = DILUTED SAMPLE			
J* = QUALIFIED AS ESTIMATED DURING QC EVALUATION			



**Figure 14-2**  
**SWMU 12 LEAD**  
**SOIL RESULTS**

ARMCO KANSAS CITY FACILITY  
AMOCO LEASED ARMCO PROPERTY





# **LEGEND**

- DIRECT-PUSH BORING LOCATION
- ⊕ RFIMONITORING WELL LOCATION
- ▲ PRE-EXISTING MONITORING WELL LOCATION
- LOCATION OF SURFACE SOIL SAMPLING GRID
- SWMU BOUNDARY
- RAILROAD
- █ TOTAL VOC RESULT BELOW SSL
- NO SAMPLE COLLECTED AT THIS DEPTH INTERVAL
- ND NOT DETECTED
- NS NOT SAMPLED
- ▤ SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.

## **NOTES:**

1. COMPOSITE GRID SURFACE SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
2. DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
3. SOIL FROM MONITORING WELL INSTALLATION COLLECTED DURING RFI INTERIM MEASURES (1996).
4. SEE SWMU 12 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.

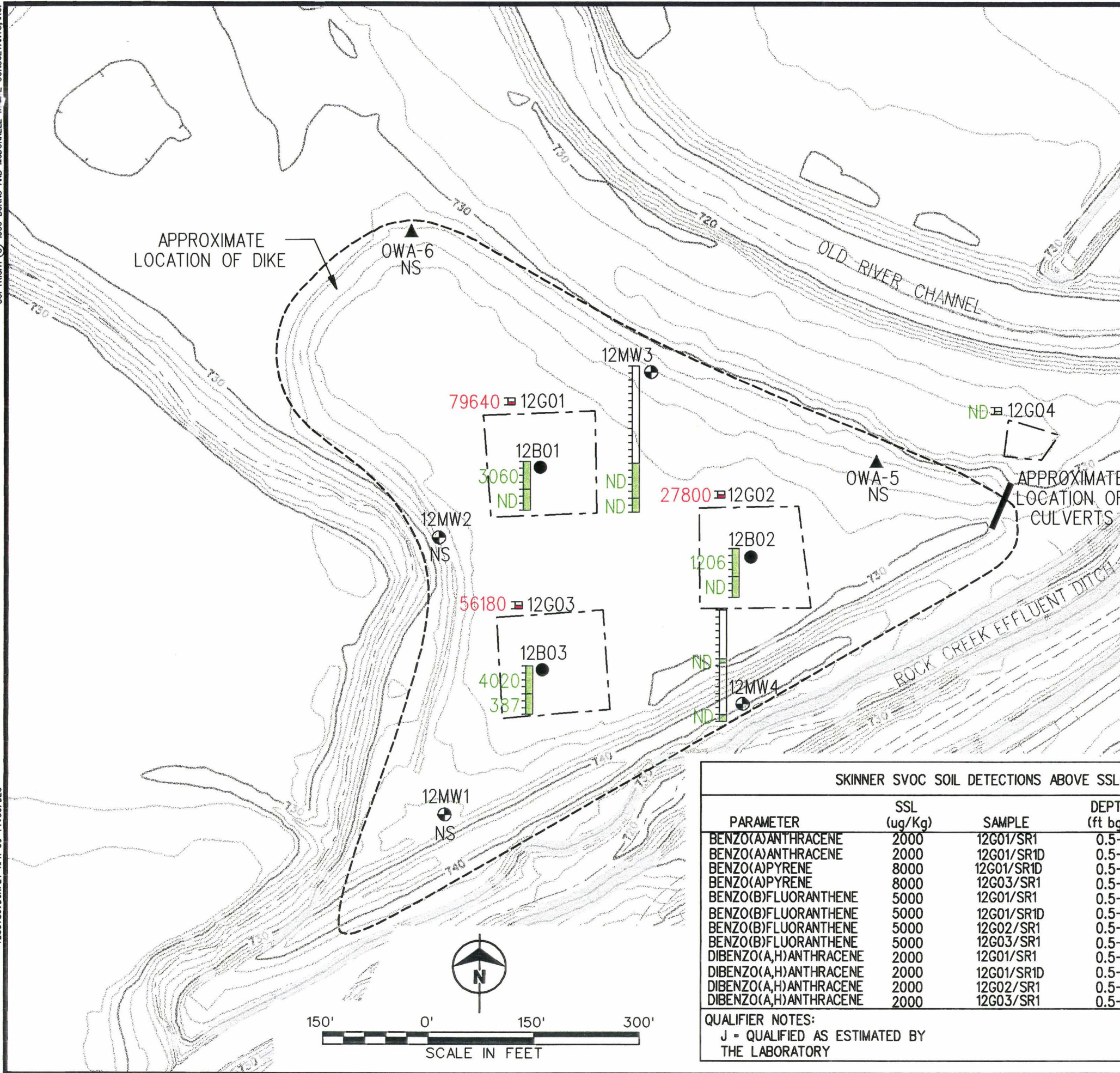


**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 14-3**  
**SWMU 12 TOTAL VOC**  
**SOIL RESULTS**

ARMCO KANSAS CITY FACILITY  
AMOCO LEASED ARMCO PROPERTY





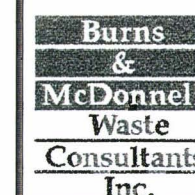
# **LEGEND**

- DIRECT-PUSH BORING LOCATION
- ⊙ RFI MONITORING WELL LOCATION
- ▲ PRE-EXISTING MONITORING WELL LOCATION
- LOCATION OF SURFACE SOIL SAMPLING GRID
- SWMU BOUNDARY
- +---+ RAILROAD
- 10 OR [red hatch] TOTAL SVOC RESULTS (ug/Kg) - ONE OR MORE SVOC DETECTIONS ABOVE SSLs (SEE INSET TABLE)
- 10 OR [green hatch] TOTAL SVOC RESULTS (ug/Kg) - ALL DETECTIONS BELOW SSLs
- [white box] NO SAMPLE COLLECTED AT THIS DEPTH INTERVAL
- ND NOT DETECTED
- NS NOT SAMPLED
- [hatch lines] SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.

## **NOTES:**

1. COMPOSITE GRID SURFACE SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
2. DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
3. SOIL FROM MONITORING WELL INSTALLATION COLLECTED DURING RFI INTERIM MEASURES (1996).
4. SEE SWMU 12 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.

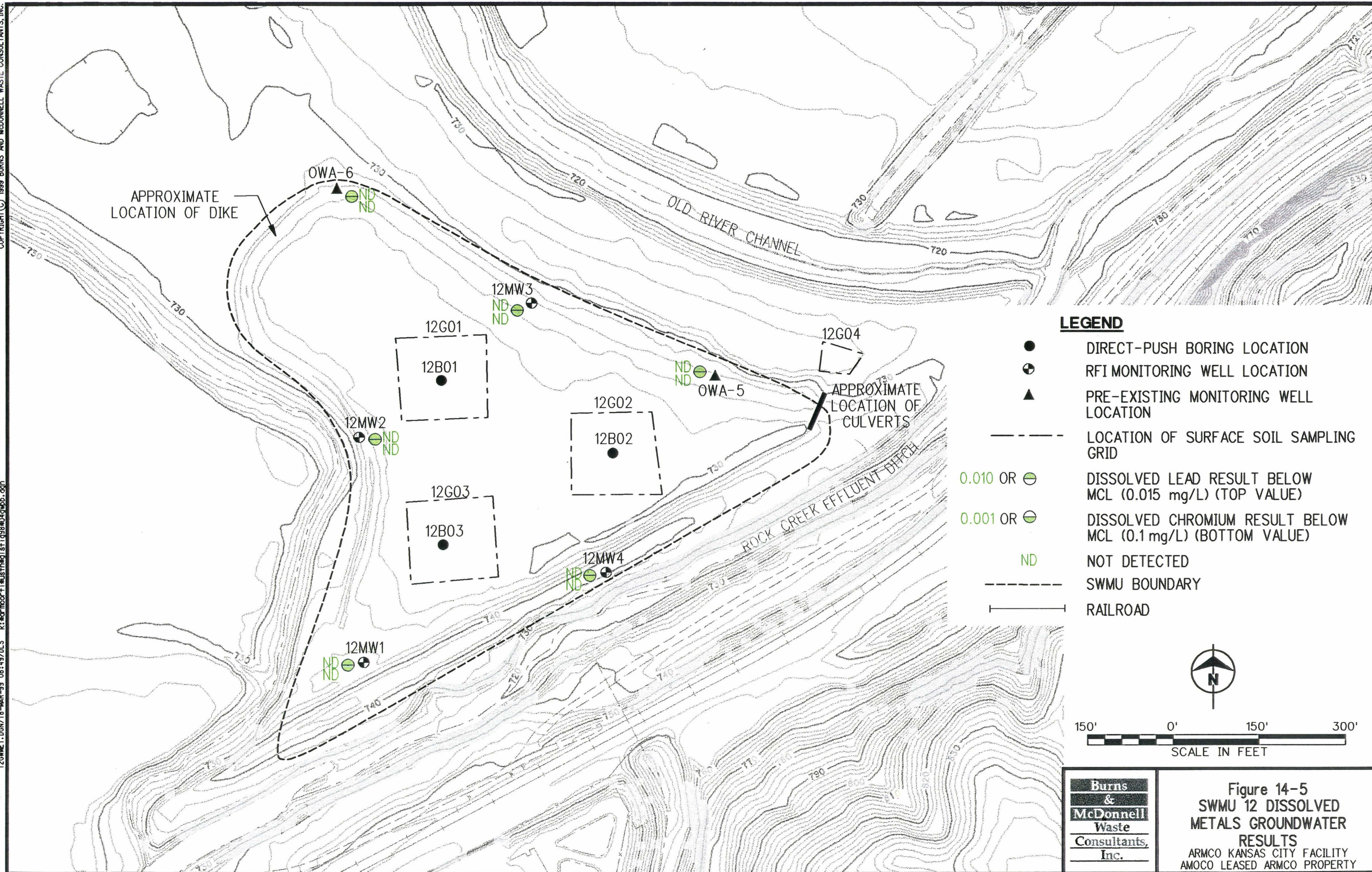
SKINNER SVOC SOIL DETECTIONS ABOVE SSLs				
PARAMETER	SSL (ug/Kg)	SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (ug/Kg)
BENZO(A)ANTHRACENE	2000	12G01/SR1	0.5-1	6740
BENZO(A)ANTHRACENE	2000	12G01/SR1D	0.5-1	3700
BENZO(A)PYRENE	8000	12G01/SR1D	0.5-1	14200
BENZO(A)PYRENE	8000	12G03/SR1	0.5-1	11700
BENZO(B)FLUORANTHENE	5000	12G01/SR1	0.5-1	15700
BENZO(B)FLUORANTHENE	5000	12G01/SR1D	0.5-1	8590
BENZO(B)FLUORANTHENE	5000	12G02/SR1	0.5-1	5560
BENZO(B)FLUORANTHENE	5000	12G03/SR1	0.5-1	9270
DIBENZO(A,H)ANTHRACENE	2000	12G01/SR1	0.5-1	17300
DIBENZO(A,H)ANTHRACENE	2000	12G01/SR1D	0.5-1	13000
DIBENZO(A,H)ANTHRACENE	2000	12G02/SR1	0.5-1	7810
DIBENZO(A,H)ANTHRACENE	2000	12G03/SR1	0.5-1	11800
QUALIFIER NOTES: J = QUALIFIED AS ESTIMATED BY THE LABORATORY				



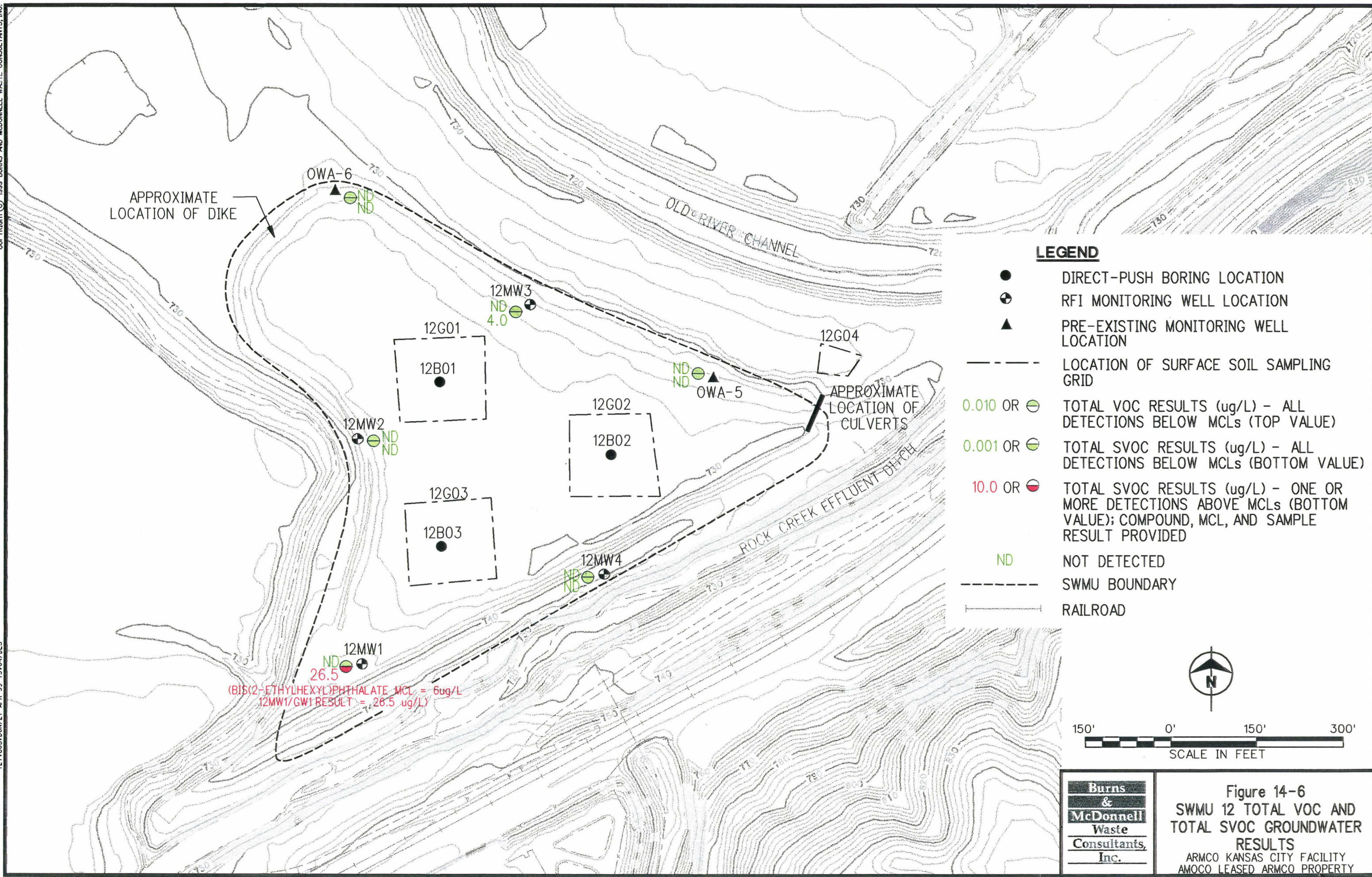
**Figure 14-4**  
**SWMU 12 TOTAL SVOC SOIL RESULTS**

ARMCO KANSAS CITY FACILITY  
AMOCO LEASED ARMCO PROPERTY









**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 14-6**  
**SWMU 12 TOTAL VOC AND**  
**TOTAL SVOC GROUNDWATER**  
**RESULTS**  
ARMCO KANSAS CITY FACILITY  
AMOCO LEASED ARMCO PROPERTY



**SWMU 13**  
**PICKLE LIQUOR TANKS**  
**(ARMCO PROPERTY)**

## **15.0 SWMU 13 – PICKLE LIQUOR TANKS**

### **15.1 SWMU BACKGROUND**

#### **15.1.1 Description of SWMU**

The pickle liquor tanks (SWMU 13), located on Armco property (see Figure 1-2), were operated from May of 1971 to 1989 and were removed in 1992. As part of the steel rod cleaning operation, sulfuric acid was used to clean iron oxide from steel rods prior to the production of nails, fence, and wire. The term used to describe this process is pickling, and the waste sulfuric acid generated by these pickling activities is referred to as spent pickle liquor.

In 1980, spent pickle liquor became a RCRA-listed hazardous waste with the waste code K062. Prior to 1981, the spent pickle liquor accumulated at this SWMU was sent off site for treatment and disposal. In 1981, Armco installed a recycling system for the spent pickle liquor that remained in use until 1989 when the steel rod cleaning operation ceased and the Cleaning House closed.

Spent pickle liquor was stored in three tanks at different times during the operational life of SWMU 13. These tanks were of varying capacities and dimensions and were located on the east side of the Cleaning House, also known as the Rod Cleaning Building. The spent pickle liquor was transferred from brick-lined acid tubs in the production line by means of overhead piping. Regeneration was accomplished by cooling the spent pickle liquor in a 3,000-gallon, rubber-lined, steel, above ground cooling tank located adjacent to the AST. The cooling caused ferrous sulfate heptahydrate to precipitate from the spent pickle liquor. From the cooling system, regenerated acid was returned to the tubs in the production line. The ferrous sulfate heptahydrate precipitant was sold to chemical supply companies for a number of uses. The most significant use was as a wastewater treatment chemical. The amount of spent pickle liquor generated during cleaning activities varied with the amount of rod cleaned.

The defined SWMU 13 area is approximately less than 0.1 acres in size. In August 1998, modifications were made in the vicinity of SWMU 13 as Armco extended Wilson Avenue in an east-west direction. As part of this modification, various concrete basement walls near SWMU 13 were lowered to below ground surface. The concrete from the walls and other imported aggregate materials were used to fill any voids in the subsurface.

Based on the types of materials handled at SWMU 13, the primary constituents of potential concern were sulfuric acid and metals. A decrease in soil or groundwater pH, or the presence of elevated concentrations of metals in groundwater suggest the presence of acids.

#### **15.1.2 Release Potential**

The only documented release of spent pickle liquor during the operational life of the SWMU involved the loss of approximately 3,000 gallons of spent pickle liquor in September 1987. The actual amount released at this SWMU was larger in volume; however all but 3,000 gallons were contained by SWMU 17 to the north of SWMU 13. After that event, procedures and secondary containment measures (additional curbing) were implemented to reduce the potential for a release to the environment, particularly the nearby surface water outfall.

The primary release potential for this SWMU was to the surrounding surface soils, subsurface soils, and groundwater. Due to the closure and removal of the SWMU, there is no ongoing potential for a release to the environment.

### **15.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at this SWMU was evaluated through the collection of subsurface soil and groundwater samples. Table 15-1 presents a summary of the investigation activities for SWMU 13, and Figure 15-1 presents the sampling locations. Based on information obtained during RFI Phase 1 concerning the actual Pickle Liquor Tank locations, the SWMU boundary and sampling locations were moved approximately 60 feet west of the boundary and locations defined in the RFI Workplan. The SWMU boundary shown on Figures 15-1 through 15-5 reflects this adjustment.

Subsurface soil samples were collected from 13 direct-push borings (Borings 13B01 through 13B11, 13B03A, and 13B07A) during RFI Phase 1. Eight of the borings (13B03A, 13B07A, and 13B06 through 13B11) were added due to signs of contamination encountered in Boring 13B02 (organic odors and PID readings up to 138 ppm) near the water table. Three to four samples were collected from each boring from the following depth intervals: 0 to 4 feet, 4 to 8 feet, 8 to 12 feet, and 12 to 16 feet bgs. For the subsurface soil samples, the original scope for SWMU 13 was for pH analysis. VOC and TPH analyses were added to samples collected from borings installed after the identification of contamination in Boring 13B02. Borings 13B03A and 13B07A were completed near their original boring locations (13B03 and 13B07, respectively) in order to collect additional subsurface soil samples for VOC, TPH (Boring 13B03A), and SVOC (Boring 13B07A) analyses.

Groundwater samples were collected from 15 direct-push borings (Borings 13B01 through 13B09, 13B11 through 13B15, and 13B07A) at SWMU 13 during RFI Phase 1. Ten of these samples were added due to signs of contamination encountered in Boring 13B02 near the water table. A water sample could not be collected from Boring 13B10 because refusal was encountered prior to reaching the water table. Groundwater samples were analyzed for dissolved RCRA metals and pH. VOC and TPH analyses were added to groundwater samples from Borings 13B01 through 13B09 and Boring 13B11 following the completion of Boring 13B02, which showed signs of organic contamination. VOC analysis was discontinued prior to the completion of Borings 13B07A and 13B12 through 13B14 due to the lack of VOC detections in the other samples; however, SVOC analysis was added to these samples. VOC and TPH analyses were added to Boring 13B15 due to a PID reading of 63 ppm. Metals analysis was not performed on the groundwater sample from Boring 13B12.

Several groundwater monitoring wells associated with SWMU 33 (see Chapter 22.0) are located in the direct vicinity of SWMU 13. Therefore, these monitoring wells (33MW5S/5I/5D, 33MW11S/11D, 33MW12S/12D, and 33MW13S/13D) were specifically sampled during RFI Phase 2 for dissolved RCRA metals and pH analyses to obtain additional information regarding SWMU 13.

This area is underlain by approximately 10 feet of gravel to boulder size slag and refractory brick fragments in a silty to sandy clay matrix. There are extensive areas of intact concrete floor remaining from demolished former mill buildings in this area. The fill layer generally thins closer to the Blue River and is thicker in buried creek channels and in buried basements below the former mill building footprints. Below the fill material is silty clay typical of Blue River alluvium. The silty clay alluvium with local, discontinuous interbeds of fine sandy clay is approximately 50 feet thick. Below the silty clay is approximately 5 feet of clayey to sandy gravel directly overlying the Pennsylvanian shale bedrock. There are two saturated zones within the unconsolidated materials. There is a shallow, unconfined saturated zone with a static groundwater surface approximately 5 to 15 feet bgs and a deeper, semi-confined saturated zone with a groundwater surface approximately 20 to 30 feet bgs.

### **15.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Table 15-2 presents the analytical results for the SWMU 13 soil samples. The following subsections present the results of the pH, VOC, and SVOC soil analyses. TPH results are presented in Appendix U.

#### **15.3.1 pH**

Figure 15-2 presents the soil pH results for 40 soil samples collected at SWMU 13. The pH results for the upper soil interval (0 to 4 feet bgs) were slightly basic to basic and ranged from pH 8.4 to 12.3. Soil pH values were neutral to acidic in the lower soil interval (12 to 16 feet bgs) and ranged from pH 7.1 to 3 at the more centrally located soil borings (Borings 13B01, 13B02, 13B03A, 13B07, and 13B09). For these borings, pH decreased with increasing sample depth. At sampling locations toward the perimeter of the area (Borings 13B04, 13B06, 13B08, and 13B11) soil pH values were slightly basic to basic throughout the entire depth interval sampled (0 to 16 feet bgs), ranging from pH 8 to pH 11.1.

### **15.3.2 VOCs**

Figure 15-2 presents the soil VOC analytical results for the 34 soil samples collected at SWMU 13. With the exception of Boring 13B06, VOCs were detected in one or more samples collected from each boring location. VOC detections were limited to 4-methyl-2-pentanone (19.9 J  $\mu\text{g/Kg}$ ) plus the common lab contaminants acetone (41.3 J to 167  $\mu\text{g/Kg}$ ), 2-butanone (16.5 to 27.9  $\mu\text{g/Kg}$ ), and methylene chloride (9.1 T to 12.8  $\mu\text{g/Kg}$ ). Acetone was the predominant constituent and was detected in 11 samples. The remaining three VOC compounds were detected in three or fewer samples each. Neither the acetone nor methylene chloride detections exceeded their 20 DAF SSLs (16,000 and 20  $\mu\text{g/Kg}$ , respectively). There are no 20 DAF SSLs for 4-methyl-2-pentanone or 2-butanone. Since no 20 DAF SSLs were exceeded, the nature and extent of VOCs in soils was adequately characterized at SWMU 13.

### **15.3.3 SVOCs**

Figure 15-3 presents the SVOC analytical results for two samples collected from Boring 13B07A at SWMU 13. The SVOCs anthracene and fluoranthene were detected at estimated concentrations below the laboratory practical quantitation limit (0.235 J and 0.223 J  $\text{mg/Kg}$ , respectively) in the sample collected from 3 to 4 feet bgs. SVOCs were not detected in the sample from the lower soil interval (4.8 to 5.8 feet bgs). Neither the anthracene nor fluoranthene detections exceeded their 20 DAF SSLs (12,000 and 4,300  $\text{mg/Kg}$ , respectively); therefore, the nature and extent of SVOC contamination in soil was adequately characterized at SWMU 13.

## **15.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Table 15-3 presents the analytical results of the groundwater sampling at SWMU 13. Table 15-4 presents the dissolved RCRA metals and pH analytical results for groundwater samples collected from wells at SWMU 33 that are in the vicinity of SWMU 13. VOC analytical data for these wells is presented and discussed with SWMU 33 (Chapter 22.0). The following subsections present the results of the dissolved RCRA metals, pH, VOC, and SVOC analyses. TPH results are presented in Appendix U.

#### **15.4.1 Dissolved Metals and pH**

Tables 15-3 and 15-4 and Figure 15-4 present the pH and dissolved RCRA metals groundwater results for SWMU 13. Table 15-5 presents the groundwater results that exceeded screening limits at SWMU 13. A total of 13 direct-push groundwater and nine monitoring well groundwater samples were collected and analyzed for pH and dissolved RCRA metals.

Groundwater pH results ranged from pH 3.9 to 8.2. Neutral pH values (pH 6 to 8) were noted for 17 of the 23 samples. Acidic pH values (below pH 6) were typically encountered toward the center of the sampling area (Well 33MW13S and Borings 13B01, 13B02, 13B04, 13B05, 13B09, and 13B15). Neutral pH values were encountered at locations around the perimeter of the sampling area (Wells 33MW11S/11D, 33MW5S/5I/5D, and 33MW12S/12D and Borings 13B06, 13B13, and 13B14). Therefore, the extent of acidic pH values in groundwater was adequately characterized at SWMU 13.

With the exception of dissolved mercury, all of the RCRA metals were detected in at least one groundwater sample. However, none of the dissolved barium, chromium, or silver detections exceeded their groundwater screening MCLs; the highest concentrations for each of these dissolved metals was 1.31, 0.0778, and 0.0266 mg/L, respectively.

Dissolved arsenic was detected in nine of the groundwater samples at concentrations up to 0.138 mg/L, and five samples had dissolved arsenic concentrations which exceeded the groundwater screening MCL (0.05 mg/L). Dissolved cadmium and lead were each detected in 10 of the groundwater samples at concentrations up to 0.0543 and 0.198 mg/L, respectively. Six samples had dissolved cadmium and lead concentrations which exceeded their groundwater screening MCLs (0.005 and 0.015 mg/L, respectively). Dissolved selenium was detected in eight groundwater samples at concentrations up to 0.187 mg/L, and six samples had dissolved selenium concentrations which exceeded the groundwater screening MCL (0.05 mg/L). As shown on Figure 15-4, these exceedences were typically limited to the central portion of the sampling area where acidic pH values were encountered. No exceedences of groundwater screening MCLs were noted in the sampling locations to the north (Wells 33MW11S/11D and Boring 13B13), west (Wells 33MW5S/5I/5D and Boring 13B11) and south (Wells



33MW12S/12D). Arsenic slightly exceeded the MCL in the sample collected from easternmost Boring 13B14. Due to direct-push refusal and physical restrictions caused by the Blue River, further sampling could not be implemented to the east.

#### **15.4.2 VOCs**

Figure 15-5 presents the VOC analytical results for groundwater at SWMU 13. Eleven direct-push groundwater samples were collected and analyzed for VOCs during RFI Phase 1.

VOCs were largely undetected in the groundwater samples. Chloroform was detected in the samples collected from Borings 13B04 (11.2 µg/L) and 13B08 (8.08 µg/L). Neither detection exceeded the groundwater screening MCL for chloroform (100 µg/L). No other VOC detections occurred in the groundwater. Therefore, the nature and extent of VOCs in groundwater was adequately defined by the sampling locations.

#### **15.4.3 SVOCs**

Figure 15-5 presents the SVOC analytical results, and Table 15-5 presents the groundwater results that exceeded screening limits for SWMU 13. Five direct-push groundwater samples were collected and analyzed for SVOCs during RFI Phase 1.

The groundwater sample collected from Boring 13B12 was the only sample with SVOC detections. PAHs (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) were detected at estimated concentrations below the laboratory reporting limit (J qualified) and ranged from 9.8 J µg/L for benzo(k)fluoranthene to 18.4 J µg/L for pyrene. Benzo(a)pyrene was detected at 11.2 J µg/L, and is the only SVOC compound to exceed a groundwater screening MCL (0.2 µg/L). MCLs have not been established for the other detected SVOC compounds. The horizontal extent of SVOCs in groundwater was well defined by samples collected to the north (Boring 13B13), east (Boring 13B14), and south (Boring 13B15) of Boring 13B12. To the west, the horizontal extent of SVOCs in groundwater was defined by Well 33MW5S whose RFI Phase 1 groundwater sample was non-detect for SVOCs (see Chapter 22.0).

## 15.5 FATE AND TRANSPORT POTENTIAL

Potential migration pathways for SWMU 13, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and the air pathway (airborne dust).

The nature and extent of contamination at SWMU 13 was assessed through the collection of subsurface soil and groundwater samples. Subsurface soil samples were analyzed for pH and neutral to acidic conditions (pH values 7.1 to 3) were noted in subsurface soil (12 to 16 feet bgs) at the location of the former pickle liquor tanks. Shallower and surrounding subsurface soils were typically slightly basic to basic (pH values 8 to 12.3). VOCs and SVOCs were detected in subsurface soil but did not exceed 20 DAF SSLs (based on soil migration to groundwater). Because of this, soil transfer to groundwater of VOCs and SVOCs is not expected to be significant for SWMU 13.

Dissolved metals, VOCs, and SVOCs were detected in groundwater. Dissolved metals exceeded MCLs in samples near the central portion of the sampling area, and groundwater pH values in these locations were typically acidic (pH 6.3 or less). As is typically expected when a decrease in pH occurs, higher concentrations of metals are dissolved into the groundwater and pH appears to have affected the mobility of naturally occurring metals in the subsurface. Perimeter samples at SWMU 13 showed neutral to basic pH values and metals typically were detected at lower concentrations (below MCLs). Limited detections of VOCs and SVOCs occurred, typically at low concentrations (below MCLs), and only one SVOC detection exceeded an MCL. Based on the limited detections of VOCs and SVOCs in groundwater and the tendency of metals to strongly adsorb to soil at neutral to basic pH values (that occur around the perimeter of SWMU 13), groundwater transport is not expected to be a significant migration pathway at SWMU 13. (Note that VOCs in groundwater will be discussed in more detail in Chapter 22.0 as part of SWMU 33.)

Surface cover material at SWMU 13 is primarily slag fill. Storm water runs toward a storm drain to the southeast of the SWMU and storm sewers discharge to the Blue River. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, and airborne dust transport are potential routes for constituent migration at SWMU 13. Based on the limited detections of constituents at SWMU 13, these pathways are not expected to be significant.

## **15.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 13.

### **15.6.1 Human Health Evaluation**

Although SVOCs and metals were identified as COPCs in groundwater at SWMU 13, there were no completed exposure pathways. Therefore, further human health risk evaluation was not performed.

### **15.6.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 13. Therefore, an ecological risk evaluation was not conducted for SWMU 13.

## **15.7 SUMMARY**

SWMU 13, located in the western portion of the Facility, were former pickle liquor tanks used for steel rod cleaning. The defined SWMU 13 area is approximately less than 0.1 acres in size. Subsurface soil and groundwater samples were collected at SWMU 13 for pH, VOC, and/or SVOC analyses.

As shown on Figures 15-2 and 15-3 the horizontal and vertical extent of soil contamination at SWMU 13 was adequately defined. Forty subsurface soil samples were analyzed for pH. Soil pH values were acidic to neutral (pH 3 to 7.1) in the soil samples near the former tank locations (at 12 to 16 feet bgs). Soil pH exhibited neutral to basic conditions (pH 8 to 12.3) in shallow soil samples collected above the former tank locations and in soil samples around the perimeter of the SWMU area. Soil VOC detections were limited to acetone (in 11 of the 34 samples) and 4-methyl-2-pentanone, 2-butanone, and methylene chloride (each in 3 or fewer of the 34 samples). Soil SVOC analysis was performed on two samples, and detections were limited to the PAH compounds anthracene and fluoranthene. None of the detected VOC or SVOC compounds exceeded their respective 20 DAF SSLs.

Thirteen direct-push and nine monitoring well groundwater samples were collected at SWMU 13 and analyzed for dissolved RCRA metals and pH. Figure 15-4 presents the extent of dissolved RCRA metals and pH in groundwater at SWMU 13. Acidic pH values (pH 3.9 to 5.9) were typically encountered in the groundwater toward the center of the sampling area, and increased to more neutral pH values (pH 6.1 to 8.2) for sampling locations toward the perimeter of the SWMU 13 area. Each of the RCRA metals except dissolved mercury was detected in at least one groundwater sample. Dissolved arsenic exceeded its groundwater screening MCL (0.05 mg/L) in five samples, ranging up to 0.138 mg/L. Dissolved cadmium, lead, and selenium exceeded their groundwater screening MCLs (0.005, 0.015, and 0.05 mg/L, respectively), in six samples each, ranging up to 0.0543, 0.177, and 0.187 mg/L, respectively. The horizontal extent of dissolved metals was adequately defined by surrounding groundwater sample locations. The eastern extent of dissolved arsenic was less clearly defined; however, further sampling could not be implemented to the east due to direct-push refusal and physical restrictions caused by the Blue River.

Figure 15-5 presents the extent of VOC and SVOC detections in groundwater at SWMU 13. Groundwater VOC detections were limited to chloroform (in 2 of 11 samples), and neither detection exceeded the groundwater screening MCL (100 µg/L). Groundwater SVOC detections were limited to PAH compounds (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) in one of the five samples. All of these

compounds were detected below the laboratory reporting limit (J qualified), and the benzo(a)pyrene result (11.2 µg/L) exceeded the 0.2 µg/L groundwater screening MCL. The horizontal extent of VOCs and SVOCs was adequately defined by surrounding groundwater sample locations in which these constituents were not detected.

Potential migration pathways at SWMU 13 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, and airborne dust migration. Subsurface soil samples showed only low concentrations of VOCs and SVOCs below 20 DAF SSLs (based on soil migration to groundwater). Groundwater samples showed detections of dissolved metals at higher concentrations in the area near the former tanks (where acidic pH conditions exist). Only limited detections of VOCs and SVOCs occurred in the groundwater. Based on the data, contaminant migration via soil transfer to groundwater and groundwater transport is not expected to be significant for SWMU 13. Based on the limited detections, contaminant migration via storm water runoff, storm sewer transport, surface water transport, and airborne dust transport is also not expected to be significant at SWMU 13.

A risk evaluation was conducted for SWMU 13. For the human health evaluation, no COPCs were identified for subsurface soil and dissolved metals and SVOCs were identified as COPCs in groundwater. There were no completed exposure pathways for the groundwater; therefore, further human health risk evaluation was not performed. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 13.

\* \* \* \* \*

**Table 15-1**  
**SWMU 13 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis					Comments	Lab ID Number
Point	Designator				VOC	SVOC	TPH	RCRA Metals	pH		
DIRECT-PUSH SUBSURFACE SOIL SAMPLES											
13B01	DP1	0 - 4	3/26/97	1	X		X		X	Matrix Spike Matrix Spike Duplicate	D97-3689-1
	DP2	4 - 8	3/26/97	1	X		X		X		D97-3689-2
	DP2MS	4 - 8	3/26/97	1	X						D97-3689-27
	DP2MSD	4 - 8	3/26/97	1	X						D97-3689-28
	DP3	8 - 12	3/26/97	1	X		X		X		D97-3689-3
	DP4	12 - 16	3/26/97	1	X		X		X		D97-3689-26
13B02	DP1	0 - 4	3/26/97	1	X		X		X		D97-3689-4
	DP2	4 - 8	3/26/97	1	X		X		X		D97-3689-5
	DP3	8 - 12	3/26/97	1	X		X		X		D97-3689-6
	DP4	12 - 16	3/26/97	1	X		X		X		D97-3689-12
13B03	DP1	0 - 4	3/26/97	1					X		D97-3689-8
	DP2	4 - 8	3/26/97	1					X		D97-3689-9
	DP3	8 - 12	3/26/97	1					X		D97-3689-10
13B03A	DP1	0 - 4	3/27/97	1	X		X			Rinsate	D97-3771-21
	DP2	4 - 8	3/27/97	1	X		X				D97-3771-22
	DP3	8 - 12	3/27/97	1	X		X				D97-3771-23
	DP4	12 - 16	3/27/97	1	X		X		X		D97-3771-25
	DP4R		3/27/97	1	X		X	X	X		D97-3771-26
13B04	DP1	0 - 4	3/26/97	1					X	Field Duplicate	D97-3689-15
	DP1D	0 - 4	3/26/97	1					X		D97-3689-16
	DP2	4 - 8	3/26/97	1					X		D97-3689-17
	DP3	8 - 12	3/26/97	1					X		D97-3689-18
13B05	DP1	0 - 4	3/26/97	1					X		D97-3689-20
	DP2	4 - 8	3/26/97	1					X		D97-3689-21
	DP3	8 - 12	3/26/97	1					X		D97-3689-22
13B06	DP1	0 - 4	3/27/97	1	X		X		X	Rinsate	D97-3771-3
	DP1R		3/27/97	1	X		X	X	X		D97-3771-4
	DP2	4 - 8	3/27/97	1	X		X		X		D97-3771-5
	DP3	8 - 12	3/27/97	1	X		X		X		D97-3771-6
	DP4	12 - 16	3/27/97	1	X		X		X		D97-3771-7
13B07	DP1	0 - 4	3/27/97	1	X		X		X		D97-3771-8
	DP2	4 - 8	3/27/97	1	X		X		X		D97-3771-9
	DP3	8 - 12	3/27/97	1	X		X		X		D97-3771-10
	DP4	12 - 16	3/27/97	1	X		X		X		D97-3771-12
13B07A	DP1	3 - 4	4/22/97	1		X					D97-4913-1
	DP2	4.8 - 5.8	4/22/97	1		X					D97-4913-2
13B08	DP1	0 - 4	3/27/97	1	X		X		X	Field Duplicate	D97-3771-13
	DP2	4 - 8	3/27/97	1	X		X		X		D97-3771-14
	DP2D	4 - 8	3/27/97	1	X		X		X		D97-3771-15
	DP3	8 - 12	3/27/97	1	X		X		X		D97-3771-16
	DP4	12 - 16	3/27/97	1	X		X		X	Matrix Spike Matrix Spike Duplicate	D97-3771-17
	DP4MS	12 - 16	3/27/97	1	X						D97-3771-18
	DP4MSD	12 - 16	3/27/97	1	X						D97-3771-19
13B09	DP1	0 - 4	3/27/97	1	X		X		X		D97-3771-29
	DP2	4 - 8	3/27/97	1	X		X		X		D97-3771-30
	DP3	8 - 12	3/27/97	1	X		X		X		D97-3771-31
	DP4	12 - 16	3/27/97	1	X		X		X		D97-3771-32
13B10	DP1	0 - 4	3/28/97	1	X		X		X		D97-3802-14
	DP2	4 - 8	3/28/97	1	X		X		X		D97-3802-15
13B11	DP1	0 - 4	3/28/97	1	X		X		X		D97-3802-16
	DP2	4 - 8	3/28/97	1	X		X		X		D97-3802-17
	DP3	8 - 12	3/28/97	1	X		X		X		D97-3802-18
	DP4	12 - 16	3/28/97	1	X		X		X		D97-3802-19

**Table 15-1**  
**SWMU 13 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis					Comments	Lab ID Number
Point	Designator				VOC	SVOC	TPH	RCRA Metals	pH		
DIRECT-PUSH GROUNDWATER SAMPLES											
13B01	DW1	24 - 26	3/27/97	1	X		X	X	X	Field Duplicate	D97-3771-1
	DW1D	24 - 26	3/27/97	1	X		X	X	X		D97-3771-2
13B02	DW1	24 - 26	3/26/97	1	X		X	X	X		D97-3689-7
13B03	DW1	43 - 45	3/26/97	1				X	X		D97-3689-11
	DW1	43 - 45	3/27/97	1	X		X				D97-3771-28
13B04	DW1	31 - 33	3/26/97	1				X	X		D97-3689-19
	DW1	31 - 33	3/27/97	1	X		X				D97-3771-20
13B05	DW1	24 - 26	3/26/97	1	X		X	X	X	Matrix Spike Matrix Spike Duplicate Matrix Spike Duplicate	D97-3689-23
	DW1MS	24 - 26	3/26/97	1	X		X	X			D97-3689-24
	DW1MSD	24 - 26	3/26/97	1			X	X			D97-3689-25
	DW1MSD	24 - 26	3/27/97	1	X						D97-3689-25
13B06	DW1	24 - 26	3/27/97	1	X		X	X	X		D97-3771-11
13B07	DW1	24 - 26	3/27/97	1	X		X	X	X		D97-3771-24
13B07A	DW1	27 - 29	4/22/97	1		X					D97-4913-3
13B08	DW1	24 - 26	3/27/97	1	X		X	X	X		D97-3771-27
13B09	DW1	24 - 26	3/27/97	1	X		X	X	X		D97-3771-33
13B11	DW1	24 - 26	3/28/97	1	X		X	X	X		D97-3802-20
13B12	DW1	28 - 30	4/22/97	1		X	X		X		D97-4913-16
13B13	DW1	8 - 18.5	5/8/97	1		X	X	X	X		D97-5706-2
13B14	DW1	9 - 17.5	5/8/97	1		X	X	X	X		D97-5706-3
13B15	DW1	13 - 21	5/8/97	1	X	X	X	X	X		D97-5706-4
MONITORING WELL GROUNDWATER SAMPLES <sup>1</sup>											
33MW5S	GW2	NA	7/17/98	2	X			X	X		D98-4944-4
	GW2D	NA	7/17/98	2	X			X	X		D98-4944-5
33MW5I	GW2	NA	7/17/98	2	X			X	X		D98-4944-6
33MW5D	GW2	NA	7/16/98	2	X			X	X		D98-4917-5
33MW11S	GW2	NA	7/14/98	2	X			X	X		D98-4875-6
33MW11D	GW2	NA	7/14/98	2	X			X	X		D98-4875-7
	GW2MS	NA	7/14/98	2	X			X	X		D98-4875-8
	GW2MSD	NA	7/14/98	2	X			X	X		D98-4875-9
33MW12S	GW2	NA	7/16/98	2	X			X	X		D98-4917-7
33MW12D	GW2	NA	7/16/98	2	X			X	X		D98-4917-6
33MW13S	GW2	NA	7/17/98	2	X			X	X		D98-4944-2
33MW13D	GW2	NA	7/17/98	2	X			X	X		D98-4944-3

Notes:

ft = feet

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

SVOC = Semivolatile Organic Compounds

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

<sup>1</sup> = Groundwater samples were collected from selected wells in the SWMU 33 area and analyzed for RCRA metals and pH.



**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B01/DP1 3/26/1997 0 4 D97-3689-1	13B01/DP2 3/26/1997 4 8 D97-3689-2	13B01/DP3 3/26/1997 8 12 D97-3689-3	13B01/DP4 3/26/1997 12 16 D97-3689-26	13B02/DP1 3/26/1997 0 4 D97-3689-4	13B02/DP2 3/26/1997 4 8 D97-3689-5	13B02/DP3 3/26/1997 8 12 D97-3689-6
<b>Volatiles</b>	<b>UNITS</b>							
2-Butanone	ug/Kg	5.43 U	6.2 U	18.6	6.47 U	5.69 U	5.53 U	29.6 DU
4-Methyl-2-pentanone	ug/Kg	109 U	124 U	137 U	129 U	114 U	111 U	592 DU
Acetone	ug/Kg	109 U	55.3 J	139	129 U	43.3 J	60.3 J	592 DU
Methylene chloride	ug/Kg	5.43 U	6.2 U	6.83 U	6.47 U	5.69 U	5.53 U	29.6 DU
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	ND	55.3	157.6	ND	43.3	60.3	ND
<b>Semivolatiles</b>	<b>UNITS</b>							
Anthracene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	11.3 J*	9.7 J*	7.3 J*	6.1 J*	8.4 J*	9.9 J*	7.3 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B02/DP4 3/26/1997 12 16 D97-3689-12	13B03/DP1 3/26/1997 0 4 D97-3689-8	13B03/DP2 3/26/1997 4 8 D97-3689-9	13B03/DP3 3/26/1997 8 12 D97-3689-10	13B03A/DP1 3/27/1997 0 4 D97-3771-21	13B03A/DP2 3/27/1997 4 8 D97-3771-22	13B03A/DP3 3/27/1997 8 12 D97-3771-23
<b>Volatiles</b>	UNITS							
2-Butanone	ug/Kg	6.31 U	NA	NA	NA	5.46 U	6.35 U	6.38 U
4-Methyl-2-pentanone	ug/Kg	126 U	NA	NA	NA	109 U	127 U	128 U
Acetone	ug/Kg	126 U	NA	NA	NA	109 U	127 U	128 U
Methylene chloride	ug/Kg	6.31 U	NA	NA	NA	5.46 U	6.35 U	6.38 U
<b>Total Detected VOCs</b>	UNITS							
<b>Total Volatiles</b>	ug/Kg	ND	NA	NA	NA	ND	ND	ND
<b>Semivolatiles</b>	UNITS							
Anthracene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	UNITS							
<b>Total Semi-Volatiles</b>	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	UNITS							
pH	SU	7.1 J*	10.1 J*	7.5 J*	6.5 J*	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B03A/DP4 3/27/1997 12 16 D97-3771-25	13B04/DP1 3/26/1997 0 4 D97-3689-15	13B04/DP1D 3/26/1997 0 4 D97-3689-16 Duplicate	13B04/DP2 3/26/1997 4 8 D97-3689-17	13B04/DP3 3/26/1997 8 12 D97-3689-18	13B05/DP1 3/26/1997 0 4 D97-3689-20	13B05/DP2 3/26/1997 4 8 D97-3689-21
<b>Volatiles</b>	UNITS							
2-Butanone	ug/Kg	6.65 U	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	ug/Kg	133 U	NA	NA	NA	NA	NA	NA
Acetone	ug/Kg	134	NA	NA	NA	NA	NA	NA
Methylene chloride	ug/Kg	9.1 T	NA	NA	NA	NA	NA	NA
<b>Total Detected VOCs</b>	UNITS							
<b>Total Volatiles</b>	ug/Kg	143.1	NA	NA	NA	NA	NA	NA
<b>Semivolatiles</b>	UNITS							
Anthracene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	UNITS							
<b>Total Semi-Volatiles</b>	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	UNITS							
pH	SU	3	10.6 J*	10.6 J*	9.8 J*	9.7 J*	10.4 J*	8.2 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B05/DP3 3/26/1997 8 12 D97-3689-22	13B06/DP1 3/27/1997 0 4 D97-3771-3	13B06/DP2 3/27/1997 4 8 D97-3771-5	13B06/DP3 3/27/1997 8 12 D97-3771-6	13B06/DP4 3/27/1997 12 16 D97-3771-7	13B07/DP1 3/27/1997 0 4 D97-3771-8	13B07/DP2 3/27/1997 4 8 D97-3771-9
<b>Volatiles</b>	<b>UNITS</b>							
2-Butanone	ug/Kg	NA	5.5 U	6.16 U	6.61 U	6.76 U	6.05 U	6.38 U
4-Methyl-2-pentanone	ug/Kg	NA	110 U	123 U	132 U	135 U	121 U	19.9 J
Acetone	ug/Kg	NA	110 U	123 U	132 U	135 U	121 U	128 U
Methylene chloride	ug/Kg	NA	5.5 U	6.16 U	6.61 U	6.76 U	6.05 U	6.38 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
Total Volatiles	ug/Kg	NA	ND	ND	ND	ND	ND	19.9
<b>Semivolatiles</b>	<b>UNITS</b>							
Anthracene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
Total Semi-Volatiles	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	7.9 J*	10.7 J*	9.2	9.7 J*	10.2 J*	10 J*	7.1 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B07/DP3 3/27/1997 8 12 D97-3771-10	13B07/DP4 3/27/1997 12 16 D97-3771-12	13B07A/DP1 4/22/1997 3 4 D97-4913-1	13B07A/DP2 4/22/1997 4.8 5.8 D97-4913-2	13B08/DP1 3/27/1997 0 4 D97-3771-13	13B08/DP2 3/27/1997 4 8 D97-3771-14	13B08/DP2D 3/27/1997 4 8 D97-3771-15 Duplicate
<b>Volatiles</b>	UNITS							
2-Butanone	ug/Kg	6.26 U	6.84 U	NA	NA	5.54 U	6.29 U	6.31 U
4-Methyl-2-pentanone	ug/Kg	125 U	137 U	NA	NA	111 U	126 U	126 U
Acetone	ug/Kg	125 U	41.3 J	NA	NA	111 U	126 U	126 U
Methylene chloride	ug/Kg	6.26 U	6.84 U	NA	NA	5.54 U	6.29 U	6.31 U
<b>Total Detected VOCs</b>	UNITS							
Total Volatiles	ug/Kg	ND	41.3	NA	NA	ND	ND	ND
<b>Semivolatiles</b>	UNITS							
Anthracene	mg/Kg	NA	NA	0.235 J	3.8 DU	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	0.223 J	3.8 DU	NA	NA	NA
<b>Total Detected SVOCs</b>	UNITS							
Total Semi-Volatiles	mg/Kg	NA	NA	0.458	ND	NA	NA	NA
<b>Physical Properties of Soil</b>	UNITS							
pH	SU	8.9 J*	6.2 J*	NA	NA	10.4 J*	8 J*	7.9 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B08/DP3 3/27/1997 8 12 D97-3771-16	13B08/DP4 3/27/1997 12 16 D97-3771-17	13B09/DP1 3/27/1997 0 4 D97-3771-29	13B09/DP2 3/27/1997 4 8 D97-3771-30	13B09/DP3 3/27/1997 8 12 D97-3771-31	13B09/DP4 3/27/1997 12 16 D97-3771-32	13B10/DP1 3/28/1997 0 4 D97-3802-14
<b>Volatiles</b>	<b>UNITS</b>							
2-Butanone	ug/Kg	6.6 U	6.11 U	5.3 U	6.71 U	6.56 U	27.9 U	5.27 U
4-Methyl-2-pentanone	ug/Kg	132 U	122 U	106 U	134 U	131 U	128 U	105 U
Acetone	ug/Kg	132 U	122 U	106 U	134 U	106 J	167 U	105 U
Methylene chloride	ug/Kg	12.8	6.11 U	5.3 U	6.71 U	6.56 U	6.41 U	5.27 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	<b>12.8</b>	<b>ND</b>	<b>ND</b>	<b>ND</b>	<b>106</b>	<b>194.9</b>	<b>ND</b>
<b>Semivolatiles</b>	<b>UNITS</b>							
Anthracene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	8.2 J*	10.3 J*	9.6 J*	7.6 J*	5.7 J*	4.8 J*	12.3 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-2**  
**SWMU 13 Phase 1 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		13B10/DP2	13B11/DP1	13B11/DP2	13B11/DP3	13B11/DP4
Date Sampled:		3/28/1997	3/28/1997	3/28/1997	3/28/1997	3/28/1997
Sample Depth From:		4	0	4	8	12
Sample Depth To:		8	4	8	12	16
Laboratory Number:		D97-3802-15	D97-3802-16	D97-3802-17	D97-3802-18	D97-3802-19
Sample Type:						
<b>Volatiles</b>	<b>UNITS</b>					
2-Butanone	ug/Kg	6.51 U	5.38 U	6.22 U	6.41 U	16.5
4-Methyl-2-pentanone	ug/Kg	130 U	108 U	124 U	128 U	130 U
Acetone	ug/Kg	47.1 J	108 U	124 U	65.6 J	137
Methylene chloride	ug/Kg	6.51 U	5.38 U	6.22 U	6.41 U	6.5 U
<b>Total Detected VOCs</b>	<b>UNITS</b>					
Total Volatiles	ug/Kg	47.1	ND	ND	65.6	153.5
<b>Semivolatiles</b>	<b>UNITS</b>					
Anthracene	mg/Kg	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>					
Total Semi-Volatiles	mg/Kg	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	<b>UNITS</b>					
pH	SU	7.9 J*	11.1 J*	10.7 J*	10.7 J*	8 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-3**  
**SWMU 13 Phase 1 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B01/DW1 3/27/97 24 26 D97-3771-1	13B01/DW1D 3/27/97 24 26 D97-3771-2 Duplicate	13B02/DW1 3/26/97 24 26 D97-3689-7	13B03/DW1 3/27/97 43 45 D97-3771-28	13B03/DW1 3/26/97 43 45 D97-3689-11	13B04/DW1 3/26/97 31 33 D97-3689-19	13B04/DW1 3/27/97 31 33 D97-3771-20
<b>Volatiles</b>	<b>UNITS</b>							
Chloroform	ug/L	5 U	5 U	5 U	5 U	NA	NA	11.2
<b>Total Detected VOCs</b>	<b>UNITS</b>							
Total Volatiles	ug/L	ND	ND	ND	ND	NA	NA	11.2
<b>Semivolatiles</b>	<b>UNITS</b>							
Benzo(a)pyrene	ug/L	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	ug/L	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	ug/L	NA	NA	NA	NA	NA	NA	NA
Chrysene	ug/L	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	ug/L	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	ug/L	NA	NA	NA	NA	NA	NA	NA
Pyrene	ug/L	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
Total Semi-Volatiles	ug/L	NA	NA	NA	NA	NA	NA	NA
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	0.0937	NA	0.01 U	0.115	NA
Barium, Dissolved	mg/L	0.0859	0.0878	0.0853 J*	NA	0.63 J*	0.0684 J*	NA
Cadmium, Dissolved	mg/L	0.0538	0.0543	0.005 UJ*	NA	0.005 UJ*	0.045 J*	NA
Chromium, Dissolved	mg/L	0.0389	0.0363	0.0236 J*	NA	0.01 UJ*	0.0778 J*	NA
Lead, Dissolved	mg/L	0.177	0.189	0.0112 J*	NA	0.003 UJ*	0.0206 J*	NA
Selenium, Dissolved	mg/L	0.168	0.187	0.06	NA	0.01 U	0.0855	NA
Silver, Dissolved	mg/L	0.02 U	0.02 U	0.0266 J*	NA	0.02 UJ*	0.0241 J*	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	6.3 J*	5.9 J*	5.7 J*	NA	6.8 J*	3.9 J*	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 15-3**  
**SWMU 13 Phase 1 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		13B05/DW1 3/26/97 24 26 D97-3689-23	13B06/DW1 3/27/97 24 26 D97-3771-11	13B07/DW1 3/27/97 24 26 D97-3771-24	13B07A/DW1 4/22/97 27 29 D97-4913-3	13B08/DW1 3/27/97 24 26 D97-3771-27	13B09/DW1 3/27/97 24 26 D97-3771-33	13B11/DW1 3/28/97 24 26 D97-3802-20
<b>Volatiles</b>	<b>UNITS</b>							
Chloroform	ug/L	5 U	5 U	5 U	NA	8.08	5 U	5 U
<b>Total Detected VOCs</b>	<b>UNITS</b>							
Total Volatiles	ug/L	ND	ND	ND	NA	8.08	ND	ND
<b>Semivolatiles</b>	<b>UNITS</b>							
Benzo(a)pyrene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Benzo(b)fluoranthene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Benzo(k)fluoranthene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Chrysene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Fluoranthene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Phenanthrene	ug/L	NA	NA	NA	20 U	NA	NA	NA
Pyrene	ug/L	NA	NA	NA	20 U	NA	NA	NA
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
Total Semi-Volatiles	ug/L	NA	NA	NA	ND	NA	NA	NA
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	0.137	0.01 U	0.0185	NA	0.01 U	0.01 U	0.01 U
Barium, Dissolved	mg/L	0.0571 J*	0.123	0.062	NA	0.0934	0.0889	0.0809
Cadmium, Dissolved	mg/L	0.0216 J*	0.005 U	0.0189	NA	0.0103	0.0529	0.005 U
Chromium, Dissolved	mg/L	0.0942 J*	0.0029 J	0.0201	NA	0.0122	0.0419	0.01 U
Lead, Dissolved	mg/L	0.0223 J*	0.003 U	0.0801	NA	0.043	0.198	0.003 U
Selenium, Dissolved	mg/L	0.0815	0.01 U	0.0637	NA	0.0325	0.162	0.01 U
Silver, Dissolved	mg/L	0.0248 J*	0.02 U	0.02 U	NA	0.02 U	0.02 U	0.0073 J
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	4.1 J*	8.2 J*	6.3 J*	NA	6.1	5.9 J*	6.5 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-3**  
**SWMU 13 Phase 1 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		13B12/DW1	13B12/DW1	13B13/DW1	13B14/DW1	13B15/DW1
Date Sampled:		4/22/97	4/22/97	5/8/97	5/8/97	5/8/97
Sample Depth From:		28	28	8	9	13
Sample Depth To:		30	30	18.5	17.5	21
Laboratory Number:		D97-4913-16	D97-4913-16R2	D97-5706-2	D97-5706-3	D97-5706-4
Sample Type:			Reanalysis			
<b>Volatiles</b>	UNITS					
Chloroform	ug/L	NA	NA	NA	NA	5 U
<b>Total Detected VOCs</b>	UNITS					
Total Volatiles	ug/L	NA	NA	NA	NA	ND
<b>Semivolatiles</b>	UNITS					
Benzo(a)pyrene	ug/L	400 DU	11.2 J	10 U	10.6 U	10.5 U
Benzo(b)fluoranthene	ug/L	400 DU	13.2 J	10 U	10.6 U	10.5 U
Benzo(k)fluoranthene	ug/L	400 DU	9.8 J	10 U	10.6 U	10.5 U
Chrysene	ug/L	400 DU	10.4 J	10 U	10.6 U	10.5 U
Fluoranthene	ug/L	400 DU	17.6 J	10 U	10.6 U	10.5 U
Phenanthrene	ug/L	400 DU	11 J	10 U	10.6 U	10.5 U
Pyrene	ug/L	400 DU	18.4 J	10 U	10.6 U	10.5 U
<b>Total Detected SVOCs</b>	UNITS					
Total Semi-Volatiles	ug/L	ND	91.6	ND	ND	ND
<b>Metals, Dissolved</b>	UNITS					
Arsenic, Dissolved	mg/L	NA	NA	0.0167	0.0646	0.138
Barium, Dissolved	mg/L	NA	NA	0.0863	0.159	0.0364
Cadmium, Dissolved	mg/L	NA	NA	0.0026 J	0.005 U	0.005 U
Chromium, Dissolved	mg/L	NA	NA	0.01 U	0.01 U	0.0154
Lead, Dissolved	mg/L	NA	NA	0.003 U	0.003 U	0.0082
Selenium, Dissolved	mg/L	NA	NA	0.01 U	0.01 U	0.0277
Silver, Dissolved	mg/L	NA	NA	0.0036 JU*	0.0068 JU*	0.0188 JU*
<b>Water Quality Parameters</b>	UNITS					
pH	SU	6 J*	NA	6.2 J*	6.2 J*	4 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-4**  
**SWMU 33 Phase 2 Groundwater Results for Metals**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW5S/GW2 07/17/1998 D98-4944-4	33MW5S/GW2D 07/17/1998 D98-4944-5 Duplicate	33MW5I/GW2 07/17/1998 D98-4944-6	33MW5D/GW2 07/16/1998 D98-4917-5	33MW11S/GW2 07/14/1998 D98-4875-6	33MW11D/GW2 07/14/1998 D98-4875-7	33MW12S/GW2 07/16/1998 D98-4917-7
<b>Metals, Dissolved</b>	<b>UNITS</b>							
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	0.0148	0.021	0.01 U	0.01 U	0.01 U
Barium, Dissolved	mg/L	0.235	0.225	0.315	1.31	0.47	0.858	0.0837
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0035 J
Chromium, Dissolved	mg/L	0.0023 J	0.0025 J	0.0026 J	0.0023 J	0.0029 J	0.0023 J	0.0035 J
Lead, Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.0026 J
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Selenium, Dissolved	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Silver, Dissolved	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.0024 J	0.005 U	0.0046 J
<b>Water Quality Parameters</b>	<b>UNITS</b>							
pH	SU	6.8 J*	7.4 J*	6.9 J*	6.8 J*	6.7 J*	7 J*	6 J*

LEGEND: B - Detected in the associated laboratory method blank F - Detected in the associated equipment rinsate blank J - Qualified as estimated by the laboratory  
R - Qualified as unusable in the QC evaluation T - Detected in associated trip blank U - Qualified as undetected by the laboratory  
NA - Not Analyzed ND - Not Detected

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-4**  
**SWMU 33 Phase 2 Groundwater Results for Metals**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		33MW12D/GW2 07/16/1998 D98-4917-6	33MW13S/GW2 07/17/1998 D98-4944-2	33MW13D/GW2 07/17/1998 D98-4944-3
<b>Metals, Dissolved</b>	<b>UNITS</b>			
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	0.01 U
Barium, Dissolved	mg/L	0.677	0.047	0.61
Cadmium, Dissolved	mg/L	0.0013 J	0.005 U	0.005 U
Chromium, Dissolved	mg/L	0.005 U	0.004 J	0.005 U
Lead, Dissolved	mg/L	0.0146	0.003 U	0.003 U
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U
Selenium, Dissolved	mg/L	0.01 U	0.01 U	0.01 U
Silver, Dissolved	mg/L	0.0108	0.005 U	0.005 U
<b>Water Quality Parameters</b>	<b>UNITS</b>			
pH	SU	6.9 J*	5.1 J*	6.8 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 15-5**  
**SWMU 13 Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
<b>Semivolatiles</b>	(µg/L)			(µg/L)
Benzo(a)pyrene	0.2	13B12 / DW1	28 - 30	11.2 J
<b>Metals</b>	(mg/L)			(mg/L)
Arsenic, Dissolved	0.05	13B02 / DW1 13B04 / DW1 13B05 / DW1 13B14 / DW1 13B15 / DW1	24 - 26 31 - 33 24 - 26 9 - 17.5 13 - 21	0.0937 0.115 0.137 0.0646 0.138
Cadmium, Dissolved	0.005	13B01 / DW1 13B01 / DW1D 13B04 / DW1 13B05 / DW1 13B07 / DW1 13B08 / DW1 13B09 / DW1	24 - 26 24 - 26 31 - 33 24 - 26 24 - 26 24 - 26 24 - 26	0.0538 0.0543 0.045 J* 0.0216 J* 0.0189 0.0103 0.0529
Lead, Dissolved	0.015	13B01 / DW1 13B01 / DW1D 13B04 / DW1 13B05 / DW1 13B07 / DW1 13B08 / DW1 13B09 / DW1	24 - 26 24 - 26 31 - 33 24 - 26 24 - 26 24 - 26 24 - 26	0.177 0.189 0.0206 J* 0.0223 J* 0.0801 0.043 0.198
Selenium, Dissolved	0.05	13B01 / DW1 13B01 / DW1D 13B02 / DW1 13B04 / DW1 13B05 / DW1 13B07 / DW1 13B09 / DW1	24 - 26 24 - 26 24 - 26 31 - 33 24 - 26 24 - 26 24 - 26	0.168 0.187 0.06 0.0855 0.0815 0.0637 0.162

**Notes:**

ft = feet

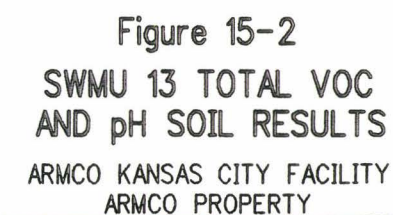
J = Estimated value; concentration below practical quantitation limit.

J\* = Qualified as estimated by BMWCI during the QC evaluation.

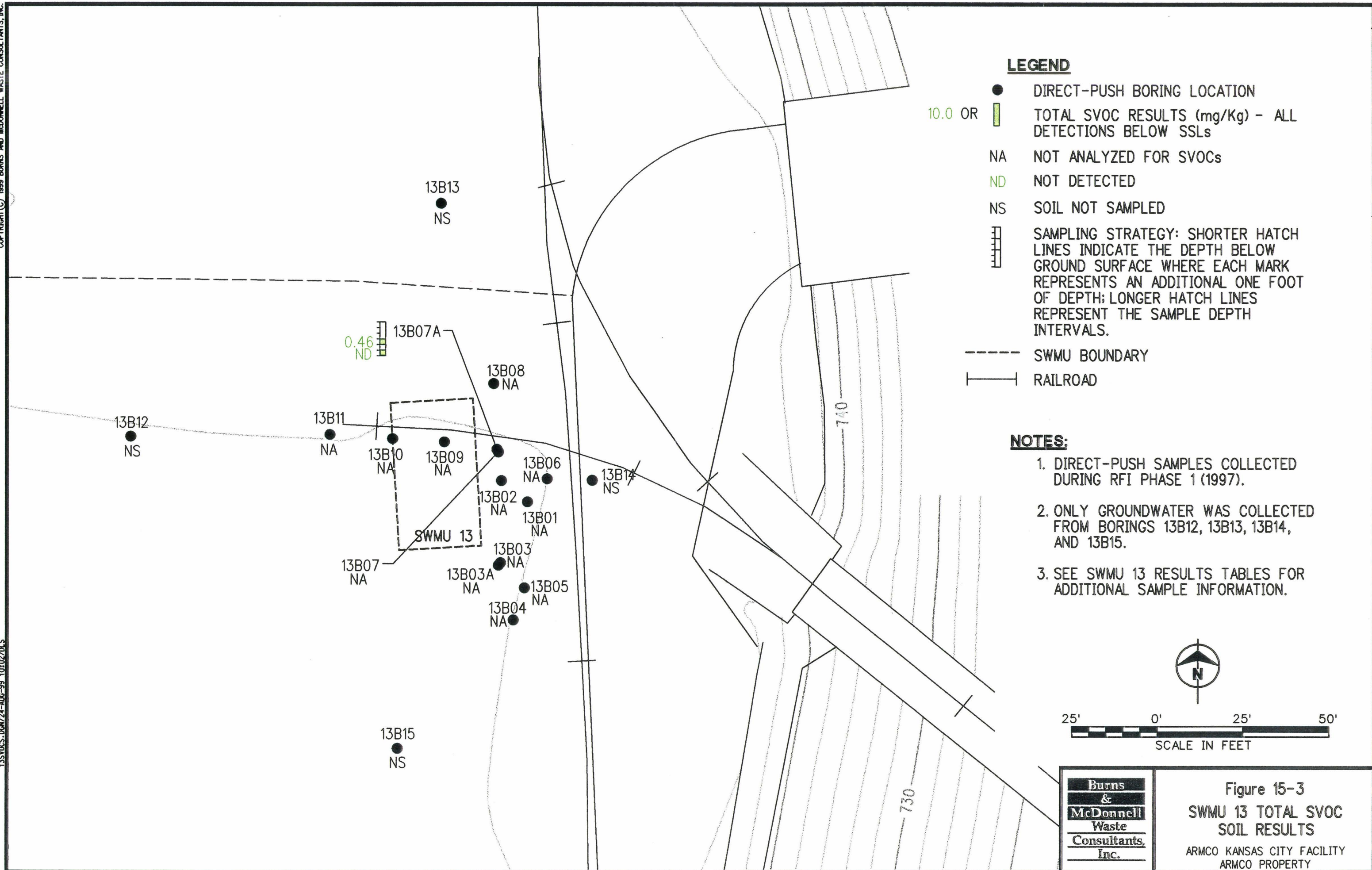
MCL = Maximum Contaminant Level









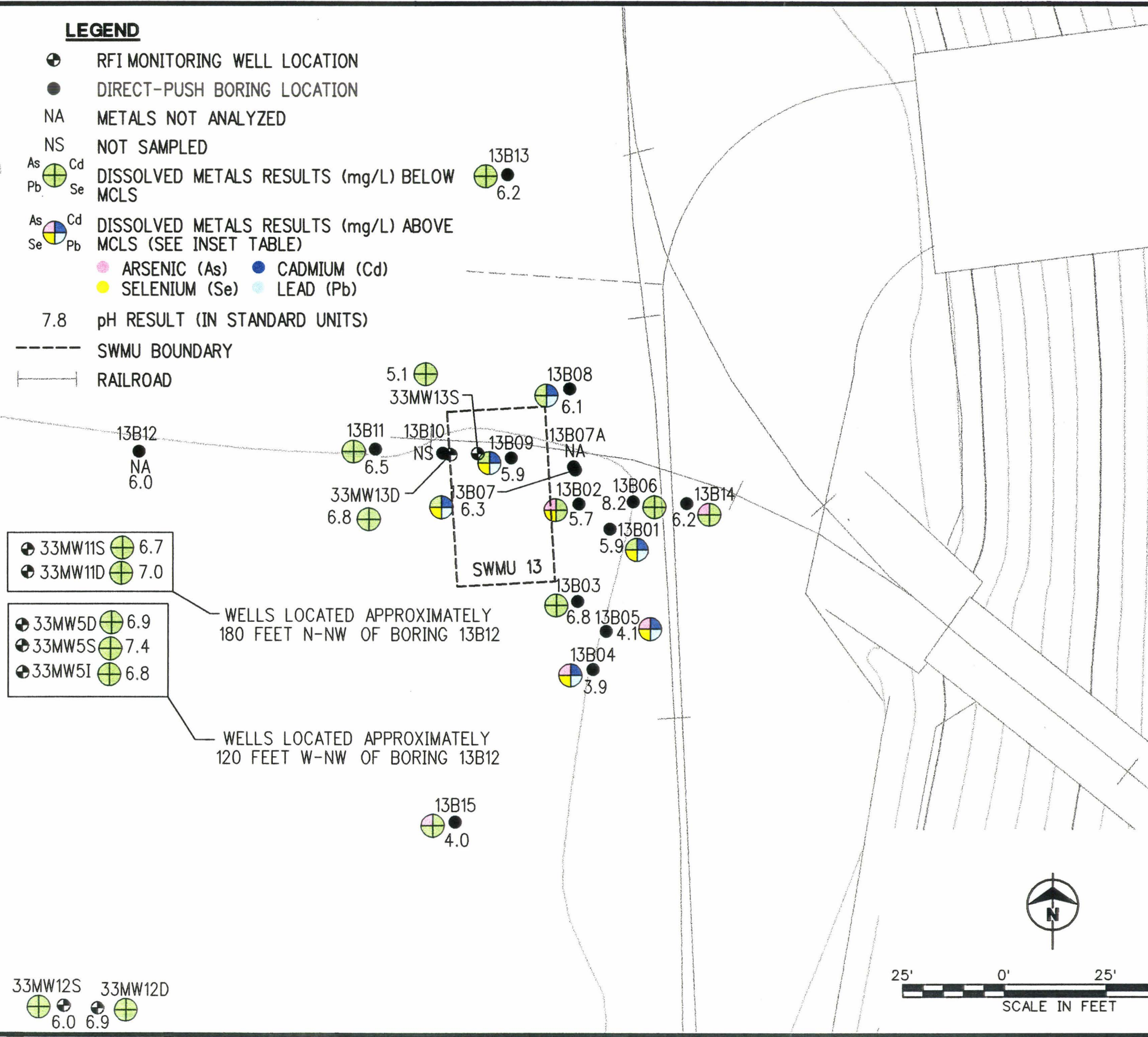




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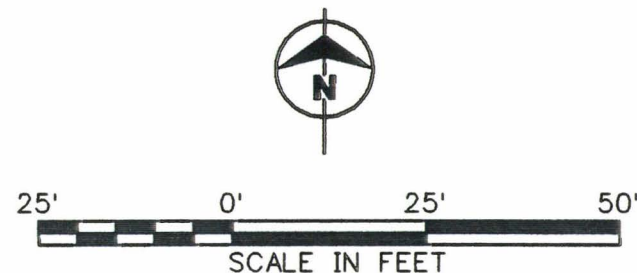
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DISSOLVED METALS GROUNDWATER DETECTIONS ABOVE MCLs			
PARAMETER	MCL (mg/L)	SAMPLE	SAMPLE RESULT (mg/L)
DISSOLVED ARSENIC	0.05	13B02/DW1	0.0937
		13B04/DW1	0.115
		13B05/DW1	0.137
		13B14/DW1	0.0646
		13B15/DW1	0.138
DISSOLVED CADMIUM	0.005	13B01/DW1	0.0538
		13B01/DW1D	0.0543
		13B04/DW1	0.045 J=
		13B05/DW1	0.0216 J=
		13B07/DW1	0.0189
		13B08/DW1	00.0103
		13B09/DW1	0.0529
DISSOLVED LEAD	0.015	13B01/DW1	0.177
		13B01/DW1D	0.189
		13B04/DW1	0.0206 J=
		13B05/DW1	0.0223 J=
		13B07/DW1	0.0801
		13B08/DW1	0.043
13B09/DW1	0.198		
DISSOLVED SELENIUM	0.05	13B01/DW1	0.168
		13B01/DW1D	0.187
		13B02/DW1	0.06
		13B04/DW1	0.0855
		13B05/DW1	0.0815
		13B07/DW1	0.0637
13B09/DW1	0.162		
QUALIFIER NOTES: J= = QUALIFIED AS ESTIMATED DURING QC EVALUATION.			

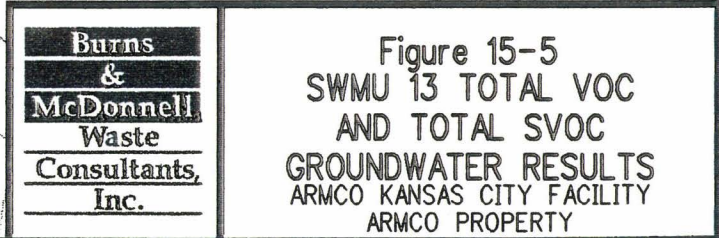
- NOTES:**
- DIRECT-PUSH GROUNDWATER SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
  - MONITORING WELL GROUNDWATER SAMPLES COLLECTED DURING RFI PHASE 2 (1998).
  - SEE SWMU 13 RESULTS TABLES FOR ADDITIONAL DIRECT-PUSH SAMPLE INFORMATION.
  - SEE SWMU 33 RESULTS TABLES FOR ADDITIONAL MONITORING WELL SAMPLE INFORMATION.



**Burns & McDonnell Waste Consultants, Inc.**

**Figure 15-4**  
**SWMU 13 DISSOLVED METALS AND pH GROUNDWATER RESULTS**  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY





**SWMU 17**  
**WIRE MILL RINSEWATER NEUTRALIZATION TANK**  
**(ARMCO PROPERTY)**

## **16.0 SWMU 17 – WIRE MILL RINSEWATER NEUTRALIZATION TANK**

### **16.1 SWMU BACKGROUND**

#### **16.1.1 Description of SWMU**

The Wire Mill Rinsewater Neutralization Tank (SWMU 17), located on Armco property (see Figure 2-1), consisted of an 18,000-gallon concrete UST with an acid-proof brick lining. The tank was open to the ground surface. The tank was installed in 1975 and was taken out of service in 1989 when operations ceased at the Cleaning House. The SWMU 17 tank was cleaned and closed in place in 1991 as part of the closure activities at the Wire Mill. The tank was located northwest of the Rod Cleaning Building under the west end of the Rod Mill Coil Conveyor Bridge (now demolished). The tank was approximately 10 feet wide, 12 feet long, and 20 feet deep.

During its operational life, this SWMU received acid rinse waters from the hydrochloric acid wire cleaning operations and the sulfuric acid rod cleaning operations. The tank was connected to the Cleaning House by a below ground pipe. The tank was used to collect acid rinse waters for treatment in the adjacent acid neutralization system. The collected rinse water was pumped from the collection tank to the neutralization system. On occasion, lime was added to the rinsewater collection tank to facilitate the neutralization process. Normally, however, lime was added to the aboveground treatment tank.

The defined SWMU area is approximately 50 feet by 80 feet (less than 0.1 acres). In August 1998, modifications were made in the area as Armco extended Wilson Avenue in an east-west direction across the west of SWMU 17. As part of this modification, the concrete walls of SWMU 17 were lowered to below ground surface. The concrete from the walls and other imported aggregate materials were used to fill the void left by the former tank. USEPA was notified of these modifications in a letter dated September 10, 1998.

Based on the types of materials handled at SWMU 17, the primary constituents of potential concern were sulfuric acid, hydrochloric acid, and possibly metals. A decrease in soil or groundwater pH, or the presence of elevated concentrations of metals in groundwater suggest the presence of acids.

#### **16.1.2 Release Potential**

The primary release potential at this SWMU was to the surrounding subsurface soils and groundwater. There are no records of any spills or releases associated with this SWMU; however, a sulfuric acid spill which occurred at SWMU 13 in 1987 flowed through acid brick lined trenches to SWMU 17. The majority of the spill was contained in this tank, which had long since ceased operation. Overflows from this tank would have flowed to nearby Outfall 006 at the Blue River. Due to the closure of the SWMU and the demolition of the wire mill and associated operations, there is no ongoing potential for a release to the environment.

### **16.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at SWMU 17 was evaluated through the collection of subsurface soil and groundwater samples. Table 16-1 presents a summary of the investigation activities for SWMU 17. Figure 16-1 presents the sampling locations. Based on new information obtained during RFI Phase 1 concerning the actual neutralization tank location, boring locations were moved approximately 100 feet southwest of the SWMU boundary as defined in the RFI Workplan. The SWMU boundary shown on Figures 16-1 and 16-2 reflect this adjustment.

Five soil borings (17B01 through 17B05) were installed during RFI Phase 1. Three samples were collected from each boring at four foot depth intervals (0 to 4 feet, 4 to 8 feet, and 8 to 12 feet bgs). Twelve samples were collected and analyzed for pH. Due to signs of contamination (sheen observed on water and organic odors) encountered in groundwater at the SWMU 17 area during RFI Phase 1, two additional soil borings (17B06A and 17B08A) were installed during RFI Phase 2. These borings were installed to evaluate if a source of VOC contamination existed at SWMU 17. At Boring 17B06A, a void was encountered at 4 feet bgs and water was

encountered below this void at 8 feet bgs; therefore, only one sample was collected from 0 to 4 feet bgs. Similarly, water was encountered at 8 feet bgs at Boring 17B08A, and samples could only be collected from the 0 to 4 feet and 4 to 8 feet bgs depth intervals. All three RFI Phase 2 soil samples were analyzed for VOCs.

During RFI Phase 1, groundwater samples were collected from nine direct-push borings (17B01 through 17B06, 17B04A, 17B08, and 17B09). Five direct-push groundwater samples had been planned in the RFI Workplan. The additional four borings were added due to signs of contamination (sheen observed on water and organic odors) encountered in the groundwater at Boring 17B04. All groundwater samples were analyzed for dissolved RCRA metals and pH. In addition, groundwater samples collected from Borings 17B04A, 17B06, 17B08, and 17B09 were analyzed for VOCs, SVOCs, and TPH. During RFI Phase 2, one additional groundwater sample was collected from Boring 17B10 and analyzed for VOCs.

This area is underlain by approximately 10 feet of gravel to boulder size slag and refractory brick fragments in a silty to sandy clay matrix. There are extensive areas of intact concrete floor remaining from demolished former mill buildings in this area. The fill layer generally thins closer to the Blue River and is thicker in buried creek channels and in buried basements below the former mill building footprints. Below the fill material is silty clay typical of Blue River alluvium. The silty clay alluvium with local, discontinuous interbeds of fine sandy clay is approximately 50 feet thick. Below the silty clay is approximately 5 feet of clayey to sandy gravel directly overlying the Pennsylvanian shale bedrock. There are two saturated zones within the unconsolidated materials. There is a shallow, unconfined saturated zone with a static groundwater surface approximately 5 to 15 feet bgs and a deeper, semi-confined saturated zone with a groundwater surface approximately 20 to 30 feet bgs.

### **16.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Figure 16-2 and Table 16-2 present the analytical results for SWMU 17. The following subsections summarize the nature and extent of soil contamination by analysis type for SWMU 17.



### **16.3.1 pH**

Fifteen samples, from depths between 0 to 12 feet bgs, were analyzed for pH. All of the samples except one exhibited slightly basic pH values from 7.8 J\* to 9.3 J\*. The sample in the 8 to 12 feet bgs interval at Boring 17B03 was an exception, and exhibited a basic pH of 11.9 J\*. With the exception of the samples collected from Boring 17B05, pH values tended to increase slightly as sample depth increased.

### **16.3.2 VOCs**

During RFI Phase 2, two direct-push borings were installed in an effort to determine if a source of VOC contamination to groundwater existed in the soil at SWMU 17. Three soil samples from depths between 0 to 8 feet bgs were collected and analyzed for VOCs. VOCs were detected in all three samples and consisted primarily of halogenated VOC compounds [i.e. 1,1-DCE, chloroform, cis-1,2-dichloroethene (cis-1,2-DCE), methylene chloride, PCE, and TCE]. Acetone, 2-butanone, and toluene were also detected. Total VOC concentrations ranged from 57.4 µg/Kg in the shallow interval at Boring 17B06A to 933.7 µg/Kg in the deep interval at 17B08A.

Table 16-3 presents the soil results that exceeded the 20 DAF SSLs at SWMU 17. TCE exceeded its 20 DAF SSL (60 µg/Kg) at all three sampling locations, with concentrations ranging from 98.4 to 655 D µg/Kg.

Both borings had TCE detections that exceeded the 20 DAF SSL in the deepest sample collected. Vertical extent of subsurface soil contamination could not be pursued further due to the presence of subsurface voids, obstructions, and/or the groundwater table. Subsurface obstructions limited sampling in the area immediately surrounding SWMU 17, the horizontal extent of contamination in the immediate SWMU area could not be pursued. However, it is not anticipated that VOC contamination is widespread outside the area of the former acid pit. In addition, soil borings installed during RFI Phase 1 at this SWMU did not show signs of VOC contamination based on visual observations or PID readings.

The goal of these VOC soil samples was to determine if a source of VOC contamination existed in the soil. Since VOCs (primarily TCE) were detected in these borings, the potential for leaching of VOCs from soil to groundwater exists. However, the SWMU 17 groundwater contamination is part of a larger plume of VOCs whose source area is primarily at SWMU 33 (see Chapter 22.0).

#### **16.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Table 16-4 and Figure 16-3 presents the direct-push groundwater results for pH and RCRA metals at SWMU 17. Discussion of the organic constituents (i.e. VOCs and SVOCs) in groundwater is presented with the SWMU 33 groundwater data in Chapter 22.0. TPH data is provided in Appendix U.

##### **16.4.1 pH**

Eight direct-push groundwater samples were collected and analyzed for pH during RFI Phase 1. The groundwater at SWMU 17 was neutral, ranging from pH 6.6 to 6.9. pH data is shown on Figure 16-3.

##### **16.4.2 Dissolved Metals**

Eight direct-push groundwater samples were collected and analyzed for dissolved RCRA metals during RFI Phase 1. With the exception of dissolved selenium, all of the RCRA metals were detected in at least one groundwater sample. However, none of the dissolved arsenic, barium, cadmium, chromium, mercury, or silver detections exceeded the groundwater screening MCLs. Dissolved barium was detected in all of the SWMU 17 groundwater samples at concentrations ranging from 0.0268 to 0.133 mg/L. Dissolved chromium was detected in four samples at concentrations ranging from 0.0022 J to 0.0164 mg/L. Dissolved silver was detected in three samples at estimated concentrations below the laboratory reporting limit (0.0033J to 0.0044J mg/L). Dissolved arsenic, cadmium, and mercury were each detected in one sample at 0.01 J, 0.0036 J, and 0.0005 mg/L, respectively.

Dissolved lead results are shown on Figure 16-3. Dissolved lead exceeded the groundwater screening MCL (0.015 mg/L) in one sample (see Table 16-5). The sample collected from Boring 17B06 (located just north of the former neutralization tank) had a dissolved lead concentration of 0.115 mg/L. The horizontal extent of dissolved lead in groundwater is assumed to be a localized occurrence and was defined by sampling locations immediately south and east of the one exceedence and by monitoring wells located to the north and west. Dissolved metals results for groundwater samples from these monitoring wells is provided with SWMU 13 (Chapter 15.0).

## **16.5 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for SWMU 17, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and air pathways (volatilization and airborne dust).

The nature and extent of contamination at SWMU 17 was assessed through the collection of subsurface soil and groundwater samples. VOC concentrations in soil exceeded 20 DAF SSLs (based on soil migration to groundwater) at depths to 8 feet bgs (approximate deepest elevation 738 feet above MSL) in the immediate area of the former rinsewater neutralization tank. Therefore, soil transfer to groundwater could occur. Soil pH values in the area of the former tank were slightly basic to basic (7.8 to 11.9).

Dissolved metals, VOCs, and SVOCs were detected in groundwater (note that VOCs and SVOCs in groundwater will be discussed in Chapter 22.0 as part of SWMU 33). Only dissolved lead exceeded the MCL in one sample near the former tank location, and all other groundwater samples showed non-detections of dissolved lead. Groundwater pH values in this area were neutral (6.6 to 6.9). Groundwater is typically encountered at approximate elevations ranging from 736 to 738 feet above MSL in this area (based on nearby Monitoring Well 33MW5S). Because of the limited detections and low concentrations of dissolved metals in groundwater and the tendency of metals to strongly adsorb to soil, groundwater transport is not expected to be a significant migration pathway for metals at SWMU 17.

Surface cover material at SWMU 17 is primarily slag fill. Storm water runs toward a storm drain to the southeast of nearby SWMU 13 and storm sewers discharge to the Blue River. Surface soil particulate (dust) could become airborne. VOCs in the subsurface may partition to the gas phase and may migrate to the air pathway. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, volatilization to air, and airborne dust transport are potential routes for constituent migration at SWMU 17.

## **16.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at SWMU 17.

### **16.6.1 Human Health Evaluation**

Groundwater data from SWMU 17 was evaluated with SWMU 33. Since no chemicals were detected in soil at concentrations exceeding risk screening levels, separate human health risk evaluation was not conducted for SWMU 17.

### **16.6.2 Ecological Evaluation**

Due to lack of sustainable habitat, ecological receptors are not expected to be affected at SWMU 17. Therefore, an ecological risk evaluation was not conducted for SWMU 17.

## **16.7 SUMMARY**

SWMU 17, located in the western portion of the Facility, was a former concrete open-topped UST that received acid rinse waters. The defined SWMU area is approximately 50 feet by 80 feet (less than 0.1 acres). Subsurface soil and groundwater samples were collected at SWMU 17 for pH, RCRA metals, and/or VOCs.

Fifteen subsurface soil samples, from depths between 0 to 12 feet bgs, were analyzed for pH. The majority of the samples exhibited neutral to slightly basic pH values (7.8 J\* to 9.3 J\*). One sample in the 8 to 12 feet bgs interval at Boring 17B03 exhibited a basic pH of 11.9 J\*.

Two soil borings were installed during RFI Phase 2 to determine if a source of VOC groundwater contamination was present in the soil at SWMU 17. VOCs were detected in all three subsurface soil samples analyzed. TCE exceeded its 20 DAF SSL (60 µg/Kg) for all three samples, ranging up to 655 D µg/Kg. Vertical extent of subsurface soil VOCs could not be pursued further due to the presence of subsurface voids, obstructions, and/or the groundwater table. The horizontal extent of VOCs in soil in the immediate SWMU area could not be defined by additional direct-push borings due to subsurface obstructions. However, it is anticipated that the horizontal extent of VOCs in soil is not widespread outside the area of the former acid tank based on PID monitoring and visual observations made during installation of Phase 1 soil borings at the SWMU. The goal of these VOC soil samples was to determine if a source of VOC contamination existed in the soil. Since VOCs (primarily TCE) were detected in these borings, the potential for leaching of VOCs from soil to groundwater exists. However, the SWMU 17 groundwater contamination is part of a larger plume of VOCs whose source area is primarily at SWMU 33 (see Chapter 22.0).

Figure 16-3 summarizes the extent of pH and dissolved lead detections in groundwater at SWMU 17. Eight direct-push groundwater samples were analyzed for pH and RCRA metals. All pH results were neutral, ranging from pH 6.6 to 6.9. With the exception of dissolved selenium, all of the RCRA metals were detected in at least one groundwater sample; however, only one dissolved lead result (0.115 mg/L) exceeded the groundwater screening MCL (0.015 mg/L). The horizontal extent of dissolved lead in groundwater is assumed to be a localized occurrence and was defined by sampling locations immediately south and east of the one exceedence and by monitoring wells located to the north and west.

Discussion of the organic constituents (i.e. VOCs and SVOCs) in groundwater is presented with the SWMU 33 groundwater data in Chapter 22.0.

Potential migration pathways at SWMU 17 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, volatilization to air, and airborne dust migration. Subsurface soil detections of VOCs exceeded 20 DAF SSLs (based on soil migration to groundwater), thus indicating that soil transfer to groundwater could occur. Groundwater samples showed one detection of dissolved lead above the MCL; however, surrounding samples were all non-detect for dissolved lead. Based on the limited detections, groundwater transport of dissolved metals is not expected to be significant for SWMU 17 (see Chapter 22.0 for an assessment of VOCs in groundwater).

Storm water runs to a storm drain located southeast of adjacent SWMU 13, and storm sewers discharge to the Blue River. Surface soil particulate (dust) could become airborne. VOCs in the subsurface may partition to the gas phase and may migrate to the air pathway. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. Thus, storm water runoff, storm sewer transport, surface water transport, volatilization to air, and airborne dust transport are potential routes for contaminant migration at SWMU 17.

A risk evaluation was conducted for SWMU 17. For the human health evaluation, no COPCs were identified for subsurface soil; therefore, further human health risk evaluation was not performed. Groundwater data from SWMU 17 was evaluated with SWMU 33 (see Chapter 22.0). Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for SWMU 17.

\* \* \* \* \*



**Table 16-1**  
**SWMU 17 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis				Comments	Lab ID Number
Point	Designator				pH	RCRA Metals	VOC	SVOC		
DIRECT-PUSH SUBSURFACE SOIL SAMPLES										
17B01	DP1	0 - 4	3/28/97	1	X					D97-3802-1
	DP2	4 - 8	3/28/97	1	X					D97-3802-2
	DP3	8 - 12	3/28/97	1	X					D97-3802-3
17B02	DP1	0 - 4	3/28/97	1	X					D97-3802-5
	DP2	4 - 8	3/28/97	1	X					D97-3802-6
	DP3	8 - 12	3/28/97	1	X					D97-3802-7
17B03	DP1	0 - 4	3/28/97	1	X					D97-3802-10
	DP2	4 - 8	3/28/97	1	X					D97-3802-11
	DP3	8 - 12	3/28/97	1	X					D97-3802-12
17B04	DP1	0 - 4	3/31/97	1	X					D97-3877-1
	DP2	4 - 8	3/31/97	1	X					D97-3877-2
	DP3	8 - 12	3/31/97	1	X					D97-3877-3
17B05	DP1	0 - 4	3/31/97	1	X				Field Duplicate	D97-3877-5
	DP1D	0 - 4	3/31/97	1	X			D97-3877-6		
	DP2	4 - 8	3/31/97	1	X			D97-3877-7		
	DP3	8 - 12	3/31/97	1	X			D97-3877-8		
17B06A	DP1	0 - 4	5/7/98	2			X		Field Duplicate	D98-3519-6
	DP1D	0 - 4	5/7/98	2			X	D98-3519-7		
17B08A	DP1	0 - 4	5/7/98	2			X			D98-3519-4
	DP2	4 - 8	5/7/98	2			X			D98-3519-5
DIRECT-PUSH GROUNDWATER SAMPLES <sup>1</sup>										
17B01	DW1	19 - 21	3/28/97	1	X	X				D97-3802-4
17B02	DW1	19 - 21	3/28/97	1	X	X			Field Duplicate	D97-3802-8
	DW1D	19 - 21	3/28/97	1	X	X		D97-3802-9		
17B03	DW1	19 - 21	3/28/97	1	X	X				D97-3802-13
17B04	DW1	19 - 21	3/31/97	1	X	X				D97-3877-4
17B04A	DW1	16 - 18	4/21/97	1	X	X	X	X		D97-4833-8
17B05	DW1	19 - 21	3/31/97	1	X	X				D97-3877-9
17B06	DW1	11.5 - 12.5	4/21/97	1	X	X	X	X		D97-4833-2
17B07	DW1		4/21/97						refusal	
17B08	DW1	13 - 15	4/21/97	1	X	X	X	X		D97-4833-3
17B09	DW1	16 - 18	4/21/97	1	X	X	X	X		D97-4833-9
17B10	DW1	15 - 17	5/14/98	2			X			D98-3694-3

**Notes:**

ft = feet

SVOC = Semivolatile Organic Compounds

RCRA Metals = Resource Conservation and Recovery Act Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

VOC = Volatile Organic Compounds

<sup>1</sup> = Direct-push groundwater sample results for organic analyses are presented and discussed with the SWMU 33 groundwater results (Chapter 22).

**Table 16-2**  
**SWMU 17 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		17B01/DP1 3/28/97 0 4 D97-3802-1	17B01/DP2 3/28/97 4 8 D97-3802-2	17B01/DP3 3/28/97 8 12 D97-3802-3	17B02/DP1 3/28/97 0 4 D97-3802-5	17B02/DP2 3/28/97 4 8 D97-3802-6	17B02/DP3 3/28/97 8 12 D97-3802-7	17B03/DP1 3/28/97 0 4 D97-3802-10
<b>Volatiles</b>	<b>UNITS</b>							
1,1-Dichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
2-Butanone	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Acetone	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Chloroform	ug/Kg	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Toluene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
pH	SU	8.1 J*	8.8 J*	8.9 J*	8.2 J*	8.9 J*	9.2 J*	8.7 J*

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 16-2**  
**SWMU 17 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		17B03/DP2	17B03/DP3	17B04/DP1	17B04/DP2	17B04/DP3	17B05/DP1	17B05/DP1D
Date Sampled:		3/28/97	3/28/97	3/31/97	3/31/97	3/31/97	3/31/97	3/31/97
Sample Depth From:		4	8	0	4	8	0	0
Sample Depth To:		8	12	4	8	12	4	4
Laboratory Number:		D97-3802-11	D97-3802-12	D97-3877-1	D97-3877-2	D97-3877-3	D97-3877-5	D97-3877-6
Sample Type:								Duplicate
<b>Volatiles</b>	<b>UNITS</b>							
1,1-Dichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
2-Butanone	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Acetone	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Chloroform	ug/Kg	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Toluene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	ug/Kg	NA	NA	NA	NA	NA	NA	NA
<b>Total Detected VOCs</b>	<b>UNITS</b>							
<b>Total Volatiles</b>	<b>ug/Kg</b>	NA	NA	NA	NA	NA	NA	NA
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
<b>pH</b>	<b>SU</b>	<b>9.3 J*</b>	<b>11.9 J*</b>	<b>7.8 J*</b>	<b>8.2 J*</b>	<b>8.3 J*</b>	<b>9 J*</b>	<b>9 J*</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinseate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 16-2**  
**SWMU 17 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		17B05/DP2 3/31/97 4 8 D97-3877-7	17B05/DP3 3/31/97 8 12 D97-3877-8	17B06A/DP1 5/7/98 0 4 D98-3519-6	17B06A/DP1D 5/7/98 0 4 D98-3519-7 Duplicate	17B08A/DP1 5/7/98 0 4 D98-3519-4	17B08A/DP2 5/7/98 4 8 D98-3519-5
<b>Volatiles</b>	<b>UNITS</b>						
1,1-Dichloroethene	ug/Kg	NA	NA	5.91 U	1.24 J	27.4 DU	25.4 DU
2-Butanone	ug/Kg	NA	NA	118 U	5.86 U	27.4 DU	98.6 D
Acetone	ug/Kg	NA	NA	118 U	117 U	548 DU	95.1 DJ
Chloroform	ug/Kg	NA	NA	1.67 J	5.86 U	17.5 DJ	25.4 DU
cis-1,2-Dichloroethene	ug/Kg	NA	NA	5.08 J	25.8 J	69.2 D	85 D
Methylene chloride	ug/Kg	NA	NA	4.48 J	2.95 J	13.8 DJ	25.4 DU
Tetrachloroethene	ug/Kg	NA	NA	21.3 J	4.51 JU*	27.4 DU	25.4 DU
Toluene	ug/Kg	NA	NA	1.61 J	5.86 U	5.73 DJ	25.4 DU
Trichloroethene	ug/Kg	NA	NA	23.3	98.4	356 D	655 D
<b>Total Detected VOCs</b>	<b>UNITS</b>						
<b>Total Volatiles</b>	<b>ug/Kg</b>	NA	NA	57.44	128.4	462.23	933.7
<b>Physical Properties of Soil</b>	<b>UNITS</b>						
pH	SU	9 J*	7.9 J*	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 16-3**  
**SWMU 17 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result
<b>Volatiles</b>	(µg/kg)			(µg/kg)
Trichloroethene	60	17B06A / DP1D	0 - 4	98.4
		17B08A / DP1	0 - 4	356 D
		17B08A / DP2	4 - 8	655 D

**Notes:**

D = Sample was diluted prior to analysis.

DAF = Dilution Attenuation Factor

ft = feet

SSL = Soil Screening Level

**Table 16-4**  
**SWMU 17 Phase 1 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		17B01/DW1 3/28/97 19 21 D97-3802-4	17B02/DW1 3/28/97 19 21 D97-3802-8	17B02/DW1D 3/28/97 19 21 D97-3802-9 Duplicate	17B03/DW1 3/28/97 19 21 D97-3802-13	17B04/DW1 3/31/97 19 21 D97-3877-4	17B04A/DW1 4/21/97 16 18 D97-4833-8	17B05/DW1 3/31/97 19 21 D97-3877-9
Metals, Dissolved	UNITS							
Arsenic, Dissolved	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U
Barium, Dissolved	mg/L	<b>0.0375</b>	<b>0.0466</b>	<b>0.046</b>	<b>0.0594</b>	<b>0.12</b>	NA	<b>0.0726</b>
Cadmium, Dissolved	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	NA	0.005 U
Chromium, Dissolved	mg/L	<b>0.0027 J</b>	0.01 U	<b>0.0026 J</b>	0.01 U	0.01 U	NA	0.01 U
Lead, Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	NA	0.003 U
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	<b>0.0005</b>	NA	0.0002 U
Silver, Dissolved	mg/L	0.02 U	<b>0.0039 J</b>	<b>0.0044 J</b>	0.02 U	0.02 U	NA	0.02 U
Water Quality Parameters	UNITS							
pH	SU	<b>6.9 J*</b>	<b>6.6 J*</b>	<b>6.7 J*</b>	<b>6.8 J*</b>	<b>6.8 J*</b>	NA	<b>6.8 J*</b>

LEGEND:

B - Detected in the associated laboratory method blank

R - Qualified as unusable in the QC evaluation

NA - Not Analyzed

F - Detected in the associated equipment rinsate blank

T - Detected in associated trip blank

ND - Not Detected

J - Qualified as estimated by the laboratory

U - Qualified as undetected by the laboratory

D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation

U\* - Qualified as undetected in the QC evaluation



**Table 16-4**  
**SWMU 17 Phase 1 Direct-Push Groundwater Results**  
**Armco Kansas City Facility**

Sample Point:		17B06/DW1	17B08/DW1	17B09/DW1	17B10/DW1
Date Sampled:		4/21/97	4/21/97	4/21/97	5/14/98
Sample Depth From:		11.5	13	16	15
Sample Depth To:		12.5	15	18	17
Laboratory Number:		D97-4833-2	D97-4833-3	D97-4833-9	D98-3694-3
Sample Type:					
<b>Metals, Dissolved</b>	<b>UNITS</b>				
Arsenic, Dissolved	mg/L	0.01 J	0.01 U	0.01 U	NA
Barium, Dissolved	mg/L	0.133	0.0603	0.0268	NA
Cadmium, Dissolved	mg/L	0.0036 J	0.005 U	0.005 U	NA
Chromium, Dissolved	mg/L	0.0164	0.0022 J	0.01 U	NA
Lead, Dissolved	mg/L	0.115	0.003 U	0.003 U	NA
Mercury, Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	NA
Silver, Dissolved	mg/L	0.0033 J	0.02 U	0.02 U	NA
<b>Water Quality Parameters</b>	<b>UNITS</b>				
pH	SU	6.7 J*	6.6 J*	6.6 J*	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinse blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory  
D - Diluted for Analysis

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

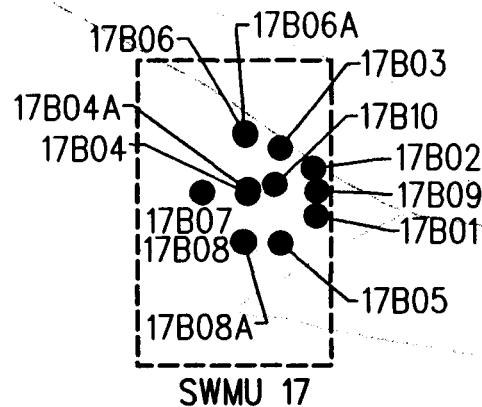
**Table 16-5**  
**SWMU 17 Groundwater Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	MCL	Sample with MCL Exceedence	Sample Depth (ft)	Sample Result
<b>Metals</b>	(mg/L)			(mg/L)
Lead	0.015	17B06 / DW1	11.5 - 12.5	0.115

Notes:

ft = feet

MCL = Maximum Contaminant Level



### LEGEND

- DIRECT-PUSH BORING LOCATION
- SWMU BOUNDARY
- +-----+ RAILROAD

### NOTE:

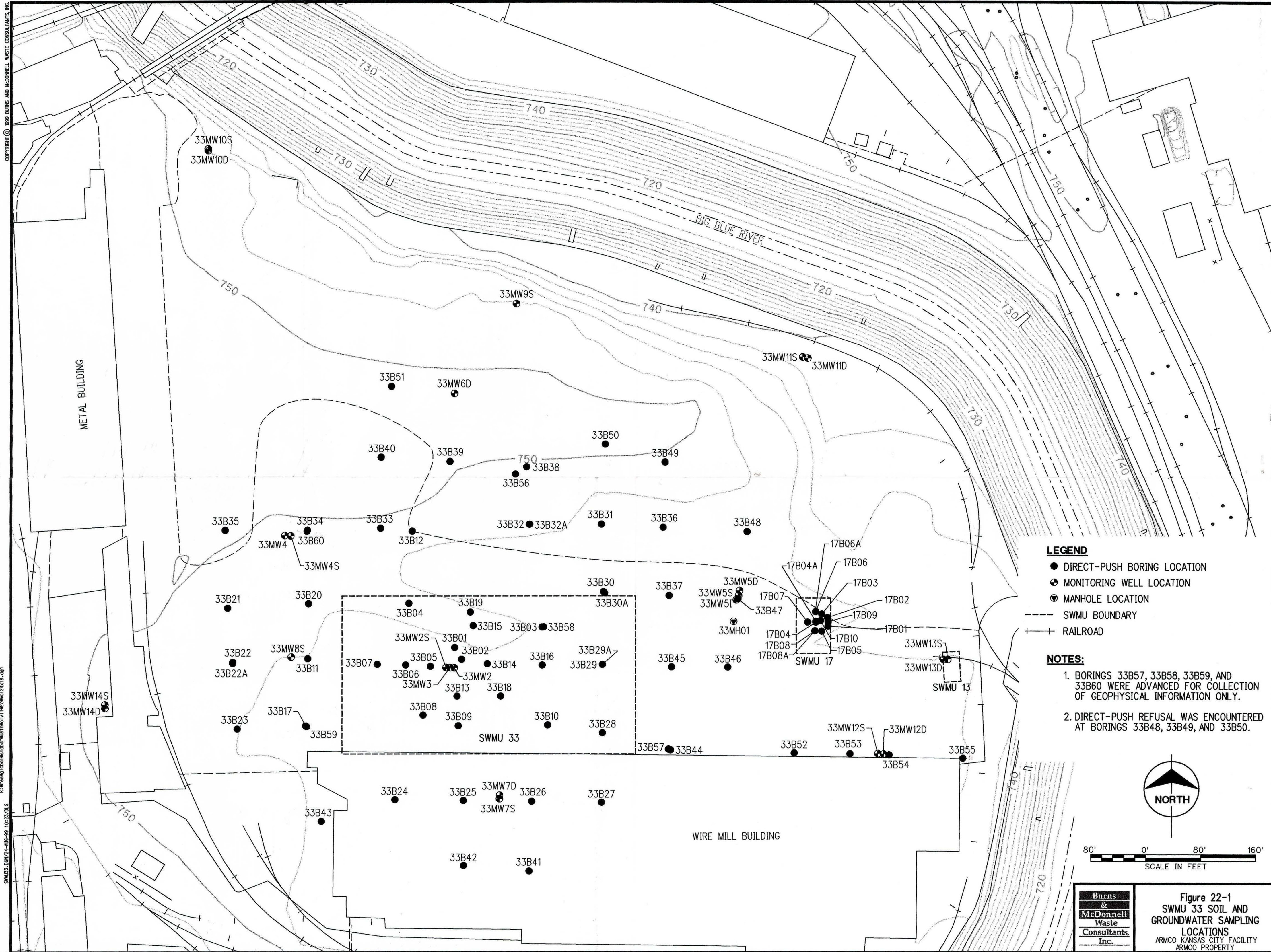
1. DIRECT-PUSH REFUSAL WAS ENCOUNTERED AT BORING 17B07.



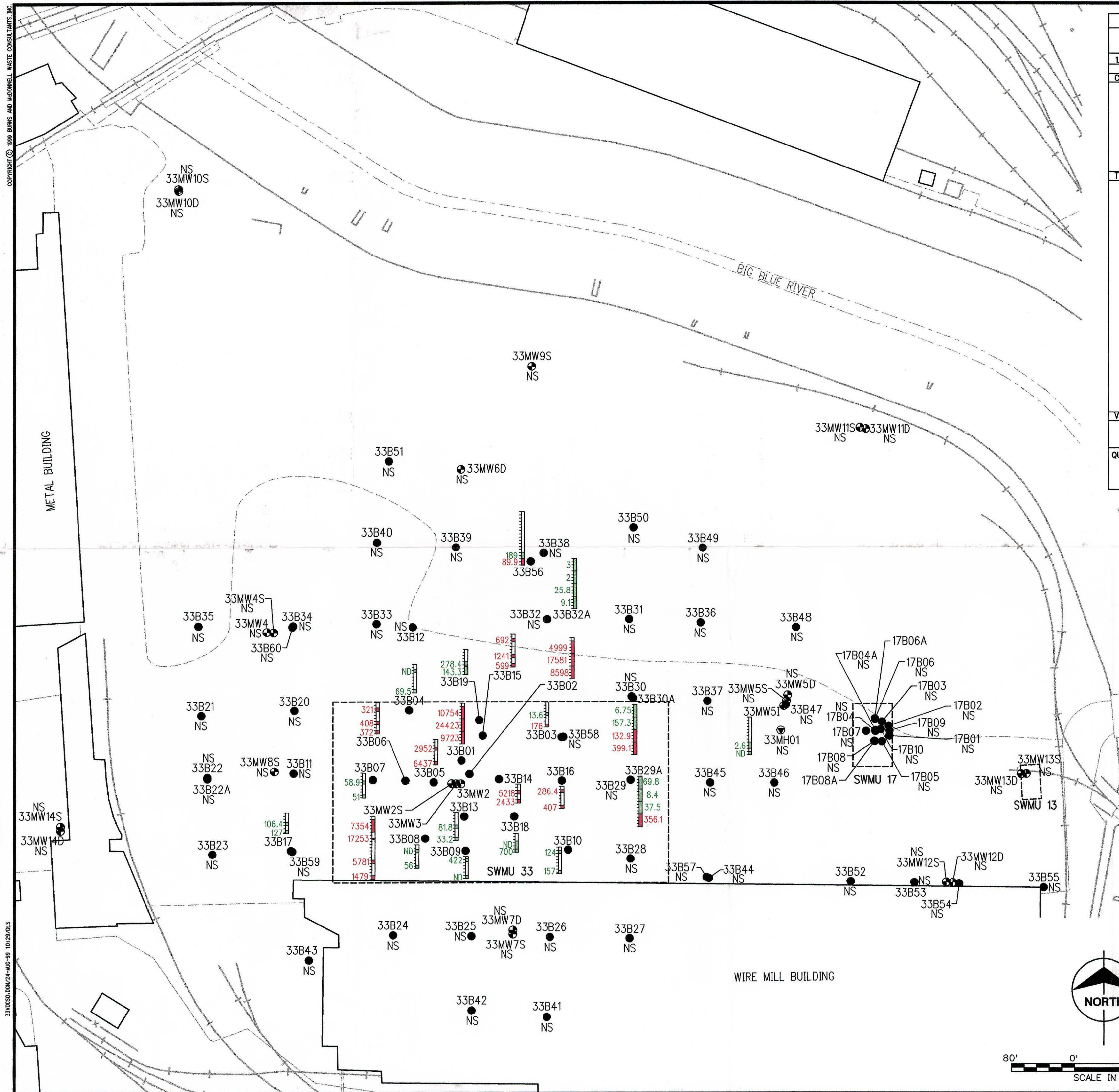
**Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.**

**Figure 16-1  
SWMU 17 SOIL AND  
GROUNDWATER SAMPLING  
LOCATIONS  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY**











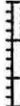





VOC SOIL DETECTIONS ABOVE DAF SSLs				
PARAMETER	DAF SSL (ug/Kg)	SAMPLE	SAMPLE DEPTH (FT BGS)	SAMPLE RESULT (ug/Kg)
1,1-DICHLOROETHENE	60	33B01/DP2	5-9	61.9
CIS-1,2-DICHLOROETHENE	400	33B01/DP1	1-5	2,570 D
		33B01/DP2	5-9	4,510 D
		33B01/DP3	9-13	1,440 D
		33B02/DP1	1-5	1,700 D
		33B02/DP2	5-9	5,070 D
		33B02/DP3	9-13	1,750 D
		33B05/DP2	7-8	540 D
		33MW2S/CS1	1-5	4,440 D
		33MW2S/CS2	7-7.5	6,180 D
		33MW2S/CS3	14-15	778 D
TRICHLOROETHENE	60	33B01/DP1	1-5	8,100 D
		33B01/DP2	5-9	19,800 D
		33B01/DP3	9-13	8,260 D
		33B02/DP1	1-5	3,290 D
		33B02/DP2	5-9	12,400 D
		33B02/DP3	9-13	6,730 D
		33B03/DP2	7-8	178
		33B05/DP1	2.5-3.5	2,580 D
		33B05/DP2	7-8	5,880 D
		33B06/DP1	1.6-2.6	297
		33B06/DP2	6-7	296 D
		33B06/DP3	9-10	261 D
		33B14/DP1	2.1-3.1	5,070 D
		33B14/DP2	5-6	2,310 D
		33B15/DP1	1.5-2.5	577 D
		33B15/DP2	6.5-7.5	1,010 D
		33B15/DP3	9.5-10.5	404 D
		33B16/DP1	1-2	202
		33B16/DP2	6-7	398 D
		33B29A/DP4	12-16	335 DJ*
		33B30A/DP3	8-12	101 J*
		33B30A/DP4	12-16	325 D
		33MW2S/CS1	1-5	2,600 D
		33MW2S/CS2	7-7.5	10,800 D
		33MW2S/CS3	14-15	4,950 D
		33MW2S/CS4	19-20	1,210 D
VINYL CHLORIDE	10	33MW2S/CS1	1-5	195
		33MW2S/CS2	7-7.5	132
		33B56/SB2	15-17	16.6

QUALIFIER NOTES:  
D = SAMPLE WAS DILUTED FOR ANALYSIS.  
J\* = QUALIFIED AS ESTIMATED DURING QC EVALUATION.

### LEGEND

-  MONITORING WELL LOCATION  
 DIRECT-PUSH BORING LOCATION  
 MANHOLE LOCATION  
10.0 OR  TOTAL VOC RESULT (ug/Kg) - ALL DETECTIONS BELOW SSLs  
10.0 OR  TOTAL VOC RESULT (ug/Kg) - ONE OR MORE DETECTIONS ABOVE SSLs (SEE INSET TABLE)  
 NO SAMPLE COLLECTED AT THIS DEPTH INTERVAL  
ND NOT DETECTED  
NS NOT SAMPLED  
 SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.  
---- SWMU BOUNDARY  
 RAILROAD

**NOTES:**

1. BORINGS 33B57, 33B58, 33B59, AND 33B60 WERE ADVANCED FOR COLLECTION OF GEOPHYSICAL INFORMATION ONLY.
2. DIRECT-PUSH REFUSAL WAS ENCOUNTERED AT BORINGS 33B48, 33B49, AND 33B50.
3. SOIL FROM INSTALLATION OF WELLS 33MW5D, 33MW6D, 33MW7D WAS ONLY ANALYZED FOR SOIL PHYSICAL CHARACTERISTICS.
4. SOIL VOC RESULTS FOR SAMPLES FROM BORINGS 17B06A AND 17B08A ARE PRESENTED WITH SWMU 17.



A horizontal graphic scale bar with alternating black and white segments. Above the bar, the markings 80', 0', 80', and 160' are indicated. Below the bar, the text "SCALE IN FEET" is written.

**Burns  
&  
McDonnell  
Waste  
Consultants  
Inc.**

Figure 22-2  
SWMU 33 TOTAL  
VOC SOIL RESULTS  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



PARAMETER	MCL (ug/L)	SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (ug/L)
TRICHLOROETHENE	5			
		17B04A/DW1	16-18	1,870 D
		17B06/DW1	11.5-12.5	1,420 D
		17B08/DW1	13-15	16,500 D
		17B09/DW1	16-18	1,940 D
		33MW2S/GW1	NA	132,000 D
		33MW2/GW1	NA	21
		33MW5S/GW1	NA	279
		33MW8S/GW1	NA	26
VINYL CHLORIDE	2			
		17B04A/DW1	16-18	173
		17B06/DW1	11.5-12.5	17
		17B08/DW1	13-15	139
		17B09/DW1	16-18	7.87
		17B10/DW1	15-17	7.58
		33MW6D/DW1	12-20	60.9
		33MW2S/GW1	NA	64.4
		33MW2/GW1	NA	1,880 D
		33MW5S/GW1	NA	30.6
NOTES:				
D = SAMPLE WAS DILUTED FOR ANALYSIS.				
J = ESTIMATED VALUE.				
J+ = QUALIFIED AS ESTIMATED DURING				
QC EVALUATION.				
NA = NOT APPLICABLE.				

### LEGEND

- MONITORING WELL LOCATION
- DIRECT-PUSH BORING LOCATION
- MANHOLE LOCATION
- ND NOT DETECTED
- NA NOT ANALYZED
- NS SHALLOW GROUNDWATER NOT SAMPLED
- OS ON-SITE VOC SCREENING DATA IS ONLY AVAILABLE FOR THE GROUNDWATER SAMPLE COLLECTED AT THIS LOCATION (SEE APPENDIX)
- OR ● TOTAL VOC RESULTS (ug/L) - ALL DETECTIONS BELOW MCLs
- OR ● TOTAL VOC RESULTS (ug/L) - ONE OR MORE DETECTIONS ABOVE MCLs (SEE INSET TABLE 2)
- SWMU BOUNDARY
- + RAILROAD

**NOTES:**

1. MONITORING WELLS WELL SAMPLES COLLECTED DURING RFI PHASE 1 IN MAY 1997.
2. DIRECT-PUSH GROUNDWATER SAMPLES COLLECTED DURING RFI PHASE 1 (1997). (SEE INSET TABLE 1).
3. MONITORING WELLS 33MW5I, 33MW10S, 33MW10D, 33MW11S, 33MW11D, 33MW12S, 33MW12D, 33MW13S, 33MW13D, 33MW14S, AND 33MW14D WERE INSTALLED DURING RFI PHASE 2 (1998).
4. BORINGS 33B51 THROUGH 33B60 WERE ADVANCED DURING RFI PHASE 2 (1998).
5. MONITORING WELLS 33MW2 AND 33MW5I ARE INTERMEDIATE DEPTH MONITORING WELLS SCREENED DIRECTLY ABOVE THE SEMI-CONFINING LAYER IN THE SHALLOW GROUNDWATER. THESE WELLS NOT USED ON CONTOURING SHALLOW GROUNDWATER DATA.
6. DIRECT-PUSH REFUSAL WAS ENCOUNTERED AT BORINGS 33B48, 33B49, AND 33B50.
7. BORINGS 33B57, 33B58, 33B59, AND 33B60 WERE ADVANCED FOR COLLECTION OF GEOPHYSICAL INFORMATION ONLY.

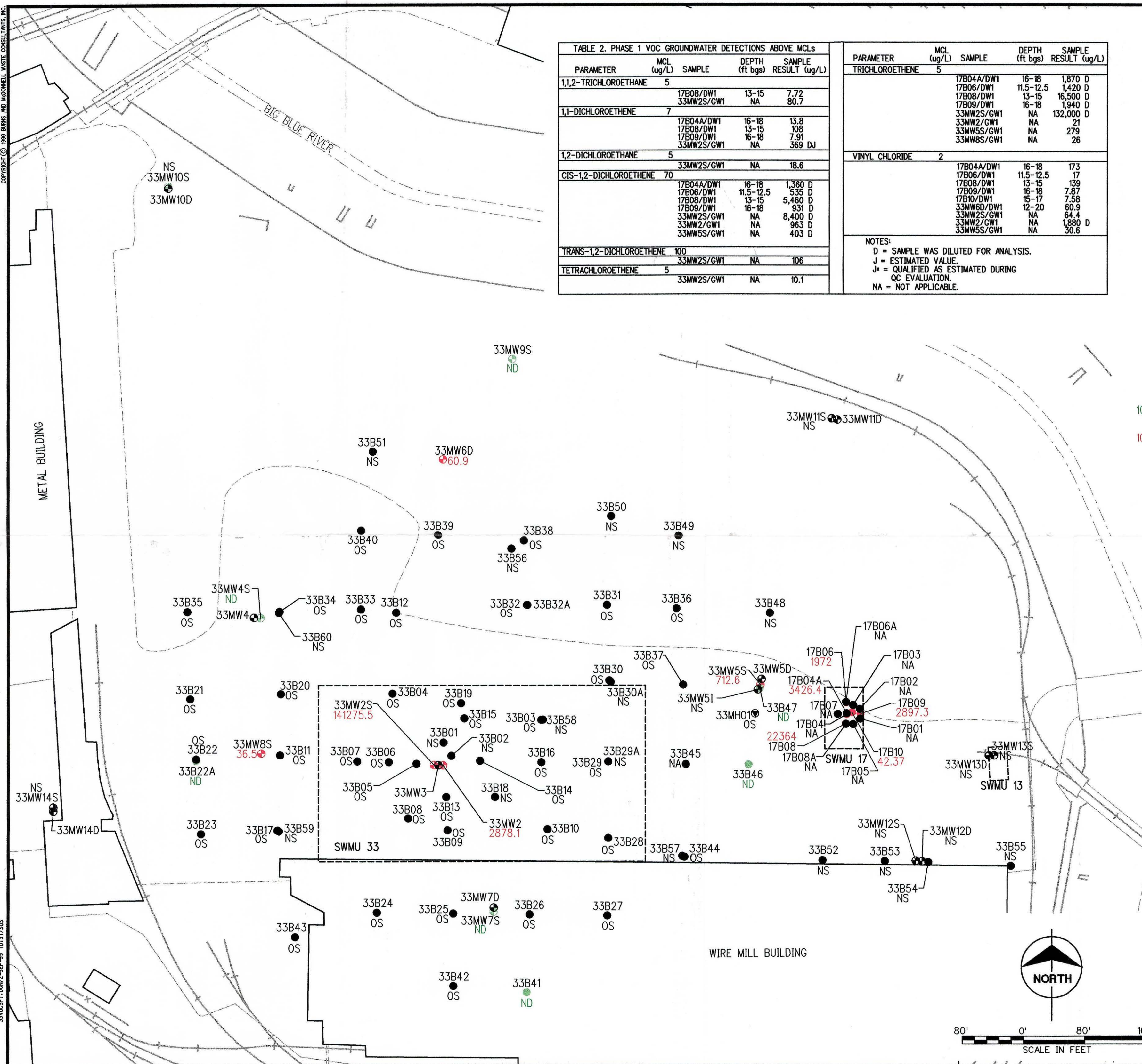


Figure 22-3  
SWMU 33 PHASE 1  
TOTAL VOC RESULTS  
SHALLOW GROUNDWATER  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



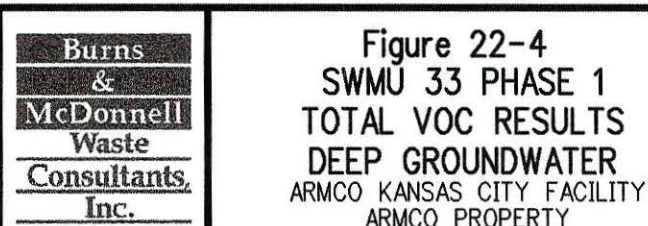




TABLE 2. VOC GROUNDWATER DETECTIONS ABOVE MCLs			
PARAMETER	MCL (ug/L)	SAMPLE	DEPTH (ft bgs) SAMPLE RESULT (ug/L)
BENZENE	5	33B51/DW1	18-20 17.8
		17B08/DW1	13-15 7.72
1,1,2-TRICHLOROETHANE	5	33MW2S/GW2	NA 42.4 J*
1,1-DICHLOROETHENE	7	17B04A/DW1	16-18 13.8
		17B08/DW1	13-15 108
1,2-DICHLOROETHANE	5	17B09/DW1	16-18 7.91
		33MW2/GW2	NA 90.8
CIS-1,2-DICHLOROETHENE	70	33MW51/GW2	NA 10.5
		33MW2S/GW2	NA 15.1 J*
METHYLENE CHLORIDE	5	17B04A/DW1	16-18 1,360 D
		17B06/DW1	11.5-12.5 535 D
TETRACHLOROETHENE	5	17B08/DW1	13-15 5,460 D
		17B09/DW1	16-18 931 D
		33MW2S/GW2	NA 58700 DJ*
		33MW2/GW2	NA 3100 D
		33MW5S/GW2	NA 386 D
		33MW5S/GW2D	NA 350 D
		33MW51/GW2	NA 1150 D
		33MW2S/GW2	NA 5.93 J*
		33MW2S/GW2	NA 23.1 J*

PARAMETER	MCL (ug/L)	SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (ug/L)
TRICHLOROETHENE	5	17B04A/DW1	16-18	1,870 D
		17B06/DW1	11.5-12.5	1,420 D
		17B08/DW1	13-15	16,500 D
		17B09/DW1	16-18	1,940 D
		33MW2S/GW2	NA	67700 D
		33MW2/GW2	NA	5230 D
		33MW5S/GW2	NA	19.2
		33MW5S/GW2D	NA	19.6
		33MW51/GW2	NA	806 D
		33MW5S/GW2	NA	51.7
VINYL CHLORIDE	2	17B04A/DW1	16-18	173
		17B06/DW1	11.5-12.5	17
		17B08/DW1	13-15	139
		17B09/DW1	16-18	7.87
		17B10/DW1	15-17	7.58
		33B51/DW1	18-20	248
		33MW6D/DW1	12-20	60.9
		33MW2S/GW2	NA	1100 DJ*
		33MW2/GW2	NA	583 D
		33MW5S/GW2	NA	26.6
		33MW5S/GW2D	NA	24.3
		33MW51/GW2	NA	12.4

NOTES:  
D = SAMPLE WAS DILUTED FOR ANALYSIS.  
J = ESTIMATED VALUE.  
J\* = QUALIFIED AS ESTIMATED DURING QC EVALUATION.  
NA = NOT APPLICABLE.

TABLE 1. DIRECT-PUSH BORINGS		
BORING	DEPTH (ft bgs)	RFI PHASE SAMPLED
33B22A	22-22.5	1
33B41	18-20	1
33B46	18-20	1
33B47	8-10	1
33B51	18-20	1
33B54	13-17	2
33B55	13-17	2
33MW6D	12-20	1
17B04A	16-18	1
17B06	11.5-12.5	1
17B08	13-15	1
17B09	16-18	1

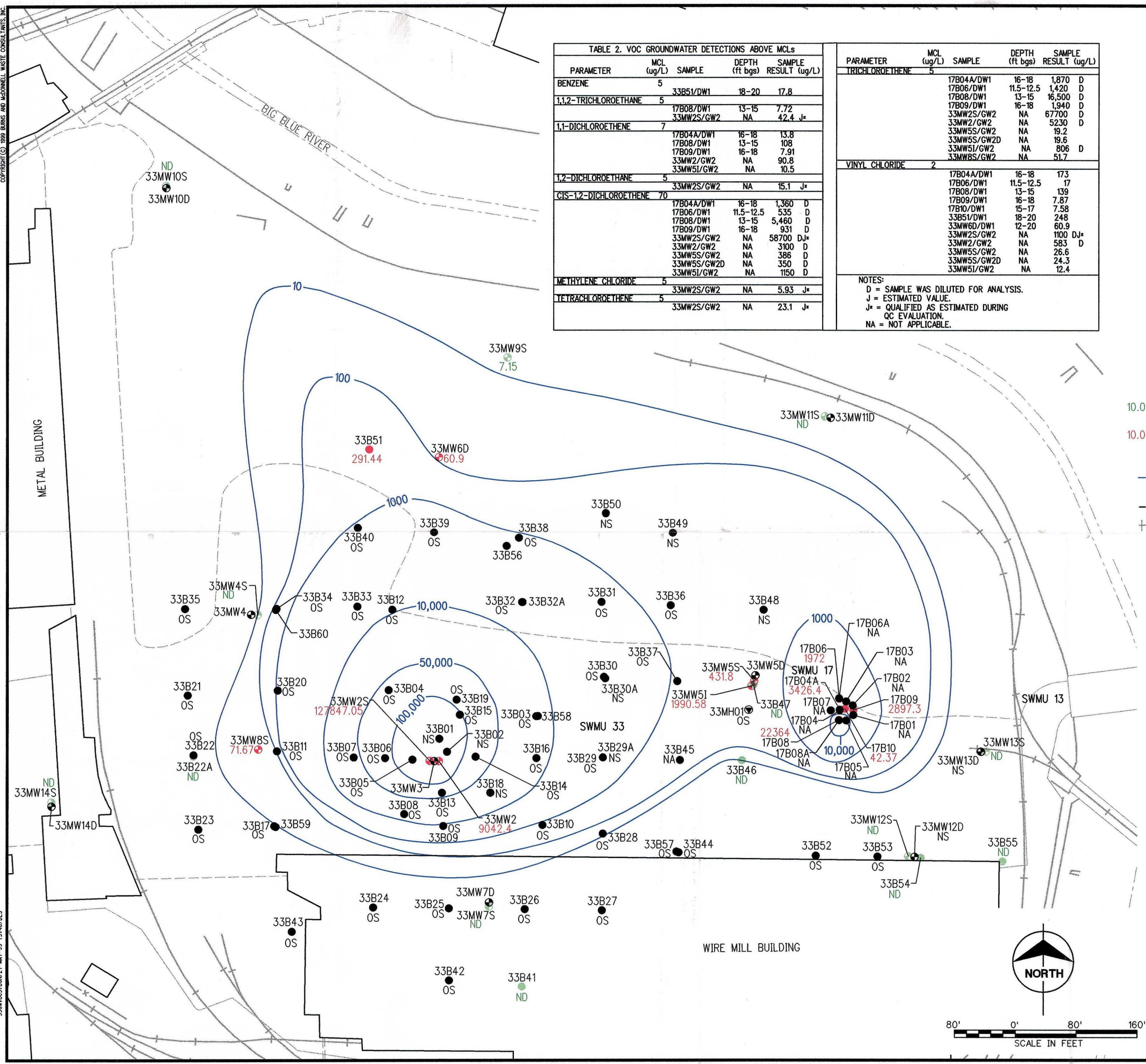
LEGEND

- MONITORING WELL LOCATION
- DIRECT-PUSH BORING LOCATION
- MANHOLE LOCATION
- ND NOT DETECTED
- NA NOT ANALYZED
- NS SHALLOW GROUNDWATER NOT SAMPLED
- OS ON-SITE VOC SCREENING DATA IS ONLY AVAILABLE FOR THE GROUNDWATER SAMPLE COLLECTED AT THIS LOCATION (SEE APPENDIX)

- 10.0 OR ● TOTAL VOC RESULTS (ug/L) - ALL DETECTIONS BELOW MCLs
- 10.0 OR ● TOTAL VOC RESULTS (ug/L) - ONE OR MORE DETECTIONS ABOVE MCLs (SEE INSET TABLE 2)
- ISOCONCENTRATION CONTOUR SHALLOW GROUNDWATER (ug/L)
- SWMU BOUNDARY
- RAILROAD

NOTES:

1. MONITORING WELL SAMPLES COLLECTED DURING RFI PHASE 2 IN JULY 1998.
2. DIRECT-PUSH GROUNDWATER SAMPLES COLLECTED DURING RFI PHASES 1 AND 2 (1997 AND 1998). (SEE INSET TABLE 1).
3. CONTOURS GENERATED BASED ON MONITORING WELL AND DIRECT-PUSH GROUNDWATER DATA AND TAKE INTO ACCOUNT GROUNDWATER FLOW DIRECTION BASED ON WATER-LEVEL ELEVATIONS FOR THAT TIME PERIOD. CONTOURS ARE INTERPOLATED BETWEEN DATA POINTS AND MAY NOT REPRESENT ACTUAL CONCENTRATIONS AT THE LOCATIONS SHOWN.
4. BORINGS 33B57, 33B58, 33B59, AND 33B60 WERE ADVANCED FOR COLLECTION OF GEOPHYSICAL INFORMATION ONLY.
5. MONITORING WELLS 33MW2 AND 33MW51 ARE INTERMEDIATE DEPTH MONITORING WELLS SCREENED DIRECTLY ABOVE THE SEMI-CONFINING LAYER IN THE SHALLOW GROUNDWATER. THESE WELLS NOT USED ON CONTOURING SHALLOW GROUNDWATER DATA.
6. DIRECT-PUSH REFUSAL WAS ENCOUNTERED AT BORINGS 33B48, 33B49, AND 33B50.



Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.

Figure 22-5  
SWMU 33 PHASE 2  
TOTAL VOC RESULTS  
SHALLOW GROUNDWATER  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



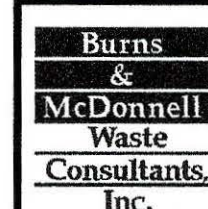


Figure 22-6  
SWMU 33 PHASE 2  
TOTAL VOC RESULTS  
DEEP GROUNDWATER  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



**AOC 1**  
**ABANDONED FUEL OIL STORAGE TANK**  
**(ARMCO PROPERTY)**

## **23.0 AOC 1 – ABANDONED FUEL OIL STORAGE TANK**

### **23.1 AOC BACKGROUND**

#### **23.1.1 Description of AOC**

The Abandoned Fuel Oil Storage Tank (AOC 1) located on Armco property (see Figure 1-2), consisted of a single AST that was used for the storage of heating oil. Oil was delivered to the oil platform by railcar, and aboveground piping was utilized for fuel transfer. The tank was installed in 1951 and had a capacity of 840,000 gallons. It was located north of U.S. Highway 24 (Independence Avenue) and east of the Big Blue River. From 1951 until 1962 it was used for the storage of No. 6 fuel oil. Beginning in 1962, and continuing until 1982, the tank was used for the storage of No. 2 fuel oil. The tank was removed from service in 1982, and was cleaned and removed in 1991. During its operation, the tank was surrounded by a containment dike. The defined AOC area is approximately 1.5 acres in size.

An oil sheen discovered on the adjacent Blue River in October 1988 was traced to this location. The sheen was discovered by COE personnel who were working along the river. Investigation activities were undertaken to determine the current conditions of the AST area and to determine if petroleum contamination was present between the tank site and the river. From November 1988 through January 1989, the COE collected soil samples from the eastern bank of the Big Blue River. In 1988 and 1989, soil samples collected by the COE had total recoverable petroleum hydrocarbons (TRPH) ranging from 38 to 728 mg/Kg and oil and grease ranging from 76 to 9,505 mg/Kg. Polychlorinated biphenyls (PCBs) were undetected (< 1 mg/Kg), and VOCs were undetected (< 1 mg/Kg) except for one sample at 12.5 mg/Kg (Remcor, 1989a).

A Preliminary Site Investigation completed in 1989 by Remcor indicated the following:

- Borings drilled in the oil unloading platform encountered mill scale fill overlying aggregate fill overlying alluvium. The mill scale fill had oil and grease concentrations less than 0.1

percent. Oil and grease concentrations in the aggregate fill ranged from 53 to 7,700 mg/Kg. One soil sample was collected from the alluvium and contained 53 mg/Kg oil and grease.

- Borings drilled in the river bank were logged as aggregate fill over alluvium. Free product was observed on the water table in this area. Remcor concluded that the source for the petroleum hydrocarbons was the oil unloading platform area. Soil samples had oil and grease concentrations ranging from nondetect to 4,300 mg/Kg.

Additional information regarding this investigation was provided in Appendix A to the RFI Workplan (BMWCI, 1996a).

Based upon the investigation, a recovery well, two observation wells, and one observation piezometer were installed at the site. Armco began recovering petroleum hydrocarbons and water from the recovery well in 1991. Recovery activities ceased in the fall of 1991 because petroleum hydrocarbons were no longer being encountered in the wells.

Based on the types of materials handled at AOC 1 and previous sampling and analysis activities completed by Remcor, the primary constituents of potential concern were petroleum hydrocarbons and PAHs associated with heating oil.

### **23.1.2 Release Potential**

There are no records of any spills or releases associated with this AOC. Because the integrity of the tank remained intact prior to its closure in 1991, any releases that may have occurred would have resulted from the unloading of fuel oil from railcars. The primary release potential for AOC 1 was to the surrounding surface soil, subsurface soil, and groundwater. The potential for surface soil contamination was limited to the area inside the containment dike. Because the tank is no longer in place, there is no ongoing threat of a release to the environment.



## 23.2 SCOPE OF ACTIVITIES COMPLETED

Potential impact to the environment was assessed through the collection of surface soil, subsurface soil, and groundwater samples. Table 23-1 presents a summary of the investigation activities for AOC 1, and Figure 23-1 depicts the sampling locations.

Composite surface soil samples were collected from fourteen grids (Grids A01G01 through A01G14) during RFI Phase 1. Due to evidence of contamination, six grids were added to the eight grids outlined in the RFI Workplan. Samples were composites of five aliquot locations from within each grid and were collected from 0 to 1 foot bgs. Samples were analyzed for PAHs and TPH.

Subsurface soil samples were collected from three direct-push borings (Borings A01B03, A01B04, and A01B07) as indicated in the RFI Workplan. Five boring locations (Borings A01B01, A01B02, A01B05, A01B06, and A01B03) were unable to be completed due to direct-push obstructions encountered at AOC 1. Subsurface soil samples were also collected from four monitoring well locations (Borings A01MW4 through A01MW7). Due to obstructions encountered in the AOC 1 area, these wells were installed by first exposing the subsurface with a heavy-duty track-hoe. Once the surface had been penetrated, a traditional drill rig was used to install the wells. Samples were collected from two to three depth intervals (typically 0 to 4, 4 to 8, and/or 8-10 feet bgs) at each boring location with total depths ranging from between 8 to 10 feet bgs. All soil samples were analyzed for PAHs and TPH.

Groundwater samples were collected from seven monitoring wells (A01MW01 through A01MW07). Four of the wells were newly installed during RFI Phase 1 and three wells (A01MW01 through A01MW03) previously existed at AOC 1. Monitoring Well A01MW7 was not planned in the RFI Workplan, but was added during RFI Phase 1 due to contamination encountered in Boring A01MW6. All groundwater samples were analyzed for VOCs, PAHs, and TPH.

This area is underlain by approximately 15 to 18 feet of gravel to boulder size slag that is extremely dense from being placed as fill while still very hot and / or from compaction from

repeated heavy truck traffic. All attempts to drill through the slag with either direct-push or hollow-stem auger drilling equipment met with refusal. Four trenches were excavated through the slag layer into the underlying silty clay sediments of the Blue River floodplain. Four monitoring wells were then drilled and completed through these trenches. Groundwater ranges from 7 to 9 feet bgs in these monitoring wells.

### **23.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL**

Tables 23-2 and 23-3 present the soil results for AOC 1 for the surface soil and subsurface soil samples. Figure 23-2 summarizes the PAH results in soil for AOC 1. TPH results are presented in Appendix U.

#### **23.3.1 PAHs**

Fourteen surface soil samples were analyzed for PAHs. Due to a miscommunication with the analytical laboratory, samples collected from Grids A01G01 through A01G08 were analyzed for PAHs by both SW-846 Method 8270 and SW-846 Method 8310. Analytical results for both methods are presented on Table 23-2, and those analyzed by Method 8310 are identified on the table with an "X" in both the sample identification and the laboratory number. Total PAH concentrations ranged from nondetect to 30.97 mg/Kg. The highest Total PAH concentration occurred in the center of AOC 1 in Grid A01G06. Each of the PAH compounds was detected in at least one sample. The most commonly detected PAHs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. Individual detections of these compounds were all at concentrations of approximately 6.5 mg/Kg or less.

Sixteen subsurface soil samples (Table 23-3) were analyzed for PAHs. Total PAH concentrations ranged from nondetect to 13.65 mg/Kg. With the exception of acenaphthene and fluorene, each of the PAH compounds was detected in at least one subsurface soil sample. The highest Total PAH concentrations (5.268 to 13.65 mg/Kg) were typically encountered in the 4 to 8 feet bgs sampling interval at the newly installed monitoring wells (A01MW4 through

A01MW7). In samples collected below 8 feet bgs, Total PAH concentrations ranged from non-detect to 1.51 mg/Kg.

None of the PAH detections in either the surface soil or subsurface soil samples exceeded their respective 20 DAF SSLs. As shown on Figure 23-2, the nature and extent of PAH detections at AOC 1 was adequately defined by the sampling locations.

## **23.4 NATURE AND EXTENT OF CONTAMINATION IN GROUNDWATER**

Groundwater samples were collected from seven wells at AOC 1 and analyzed for VOCs, PAHs, and TPH. Table 23-4 and Figure 23-3 present the VOC and PAH results. TPH results are presented in Appendix U.

### **23.4.1 VOCs**

VOCs were not detected in groundwater samples collected from six of the seven monitoring wells. For the groundwater sample collected from Well A01MW1 (located along the western edge of AOC 1 adjacent to the channelized portion of the Big Blue River), acetone (26.1 J  $\mu\text{g/L}$ ) and vinyl acetate (25.5 J  $\mu\text{g/L}$ ) were detected at concentrations below the laboratory's reporting limit (J qualified). Groundwater screening MCLs have not been established for these VOC compounds. As shown on Figure 23-3, the nature and extent of VOC detections at AOC 1 was adequately characterized by the wells surrounding Well A01MW1.

### **23.4.2 PAHs**

PAHs were not detected in groundwater samples collected from six of the seven monitoring wells. For the groundwater sample collected from Well A01MW6 (located in the southwest portion of AOC 1), naphthalene (9.7 J  $\mu\text{g/L}$ ) was detected at a concentration below the laboratory's standard reporting limit (J qualified). A groundwater screening MCL has not been established for naphthalene. As shown on Figure 23-3, the nature and extent of PAH detections at AOC 1 was adequately characterized by the wells in the vicinity of Well A01MW6.

## **23.5 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for AOC 1, as summarized in Table 3-1, include subsurface pathways (soil transfer to groundwater, groundwater transport, and storm sewers), surface pathways (storm water runoff and surface water transport), and the air pathway (airborne dust).

The nature and extent of contamination at AOC 1 was assessed through the collection of surface soil, subsurface soil, and groundwater samples. PAHs in soil were not detected at concentrations exceeding 20 DAF SSLs (based on soil migration to groundwater). In the groundwater, only limited detections of VOCs and PAHs occurred at low concentrations. Based on the limited detections of constituents in the soil and groundwater, soil transfer to groundwater, storm sewer transport, and groundwater transport are not expected to be significant constituent migration pathways for AOC 1.

Surface cover material at AOC 1 is primarily slag fill. Storm water either ponds and infiltrates in the immediate AOC area or runs directly to the Blue River in the western-most portion of AOC 1. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. However, based on the data, constituent migration via storm water runoff, surface water transport, and airborne dust transport is not expected at AOC 1.

## **23.6 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted for AOC 1.

### **23.6.1 Human Health Evaluation**

No chemicals exceeded risk screening levels in groundwater, therefore risk assessment for groundwater was not conducted for AOC 1. SVOCs were identified as COPCs in both surface and subsurface soil. A HHRA was conducted for AOC 1 to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that there are no significant

noncarcinogenic health effects or carcinogenic risks posed by the COPCs detected in soil at AOC 1. Assumptions and variables used in risk calculations are discussed further in Chapter 4.0 of Appendix X. The results of the risk characterization are presented in Chapter 5.0 of Appendix X.

### **23.6.2 Ecological Evaluation**

Due to lack of sustainable habitat for ecological receptors at AOC 1, an ecological risk evaluation was not conducted.

## **23.7 SUMMARY**

AOC 1, located in the western portion of the Facility, was a former AST used for the storage of heating oil. The defined AOC area is approximately 1.5 acres in size. Surface soil, subsurface soil, and groundwater samples were collected at AOC 1.

As shown on Figure 23-2, the nature and extent of surface and subsurface soil contamination at AOC 1 was adequately characterized by the analytical data collected. PAHs were detected in all 14 surface soil samples and in the majority of the 16 subsurface soil samples. However, none of the PAH detections exceeded 20 DAF SSLs.

As shown on Figure 23-3, the nature and extent of groundwater contamination at AOC 1 was adequately characterized by the analytical data collected. VOCs (acetone and vinyl acetate) were only detected in the sample collected from Well A01MW1. PAHs (naphthalene) were only detected in the sample collected from Well A01MW6. All detections were below the laboratory's reporting limits (J qualified). No groundwater screening MCLs have been established for these compounds. However, the extent of these limited VOC and PAH detections was adequately characterized by samples collected from wells in the immediate area.

Potential migration pathways at AOC 1 include soil transfer to groundwater, groundwater transport, storm sewer transport, storm water runoff, surface water transport, and airborne dust migration. PAHs were not detected in soil samples at concentrations that exceeded 20 DAF SSLs (based on soil migration to groundwater). Only limited detections of VOCs and PAHs

occurred in the groundwater, all at low concentrations. Based on the data, constituent migration via soil transfer to groundwater, groundwater transport, and storm sewer transport is not expected for AOC 1. In addition, constituent migration via storm water runoff to the Blue River, surface water transport, and/or dust migration via the air pathway are not expected at AOC 1.

A risk evaluation was conducted for AOC 1. For the human health evaluation, no COPCs were identified for groundwater and further risk assessment for is was not conducted. PAHs were identified as COPCs in surface and subsurface soil. Therefore, a HHRA was conducted to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. No significant risk was posed by the COPCs in soil at AOC 1 for these exposure scenarios. Due to lack of sustainable habitat for ecological receptors, an ecological risk evaluation was not conducted for AOC 1.

\* \* \* \* \*



**Table 23-1**  
**AOC 1 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis			Comments	Lab ID Number
Point	Designator				VOC	PAH	TPH		
COMPOSITE SURFACE SOIL GRIDS									
A01G01	SR1	0 - 1	3/13/97	1		X	X	Rinsate	D97-3053-1
	SR1R		3/13/97	1		X	X		D97-3053-2
A01G02	SR1	0 - 1	3/13/97	1		X	X		D97-3053-3
A01G03	SR1	0 - 1	3/13/97	1		X	X		D97-3053-4
A01G04	SR1	0 - 1	3/13/97	1		X	X	Field Duplicate	D97-3053-5
	SR1D	0 - 1	3/13/97	1		X	X		D97-3053-6
A01G05	SR1	0 - 1	3/13/97	1		X	X		D97-3053-7
A01G06	SR1	0 - 1	3/13/97	1		X	X		D97-3053-8
A01G07	SR1	0 - 1	3/13/97	1		X	X	Matrix Spike Matrix Spike Duplicate	D97-3053-9
	SR1MS	0 - 1	3/13/97	1		X			D97-3053-10
	SR1MSD	0 - 1	3/13/97	1		X			D97-3053-11
A01G08	SR1	0 - 1	3/13/97	1		X	X		D97-3053-12
A01G09	SR1	0 - 1	5/9/97	1		X	X		D97-5737-1
A01G10	SR1	0 - 1	5/9/97	1		X	X		D97-5737-2
A01G11	SR1	0 - 1	5/9/97	1		X	X		D97-5737-3
A01G12	SR1	0 - 1	5/9/97	1		X	X		D97-5737-4
A01G13	SR1	0 - 1	5/9/97	1		X	X		D97-5737-5
A01G14	SR1	0 - 1	5/9/97	1		X	X		D97-5737-6
DIRECT-PUSH SUBSURFACE SOIL AND BOREHOLE SAMPLES <sup>1</sup>									
A01B03	DP1	0 - 4	3/25/97	1		X	X	Matrix Spike Matrix Spike Duplicate	D97-3598-1
	DP1MS	0 - 4	3/25/97	1		X			D97-3598-2
	DP1MSD	0 - 4	3/25/97	1		X			D97-3598-3
	DP2	4 - 8	3/25/97	1		X	X		D97-3598-4
	DP3	8 - 9	3/25/97	1		X	X		D97-3598-5
A01B04	DP1	0 - 4	3/25/97	1		X	X	Rinsate	D97-3598-6
	DP2	4 - 8	3/25/97	1		X	X		D97-3598-7
	DP3	8 - 10	3/25/97	1		X	X		D97-3598-8
	DP3R		3/25/97	1		X	X		D97-3598-9
A01B07	DP1	0 - 3	3/26/97	1		X	X		D97-3689-14
A01MW4	SB1	0 - 4	4/29/97	1		X	X	Field Duplicate	D97-5313-5
	SB1D	0 - 4	4/29/97	1		X	X		D97-5313-6
	SB2	4 - 8	4/29/97	1		X	X		D97-5313-7
A01MW5	SB1	0 - 4	4/29/97	1		X	X		D97-5313-1
	SB2	4 - 8	4/29/97	1		X	X		D97-5313-2
A01MW6	SB1	0 - 4	4/30/97	1		X	X		D97-5313-9
	SB2	4 - 8	4/30/97	1		X	X		D97-5313-10
	SB3	8 - 10	4/30/97	1		X	X		D97-5313-11
A01MW7	SB1	0 - 4	4/29/97	1		X	X		D97-5313-3
	SB2	4 - 8	4/29/97	1		X	X		D97-5313-4
MONITORING WELL GROUNDWATER SAMPLES									
A01MW1	GW1	NA	5/13/97	1	X	X	X		D97-5891-7
A01MW2	GW1	NA	5/13/97	1	X	X	X		D97-5891-8
A01MW3	GW1	NA	5/13/97	1	X	X	X		D97-5891-9
A01MW4	GW1	NA	5/12/97	1	X	X	X		D97-5825-14
A01MW5	GW1	NA	5/13/97	1	X	X	X	Field Duplicate	D97-5891-1
	GW1D	NA	5/13/97	1	X	X	X		D97-5891-2

**Table 23-1**  
**AOC 1 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Chemical Analysis			Comments	Lab ID Number
Point	Designator				VOC	PAH	TPH		
A01MW6	GW1	NA	5/13/97	1	X	X	X		D97-5891-3
A01MW7	GW1	NA	5/13/97	1	X	X	X		D97-5891-4
	GW1MS	NA	5/13/97	1	X	X		Matrix Spike	D97-5891-5
	GW1MSD	NA	5/13/97	1	X	X		Matrix Spike Duplicate	D97-5891-6

**Notes:**

ft = feet

PAH = Polyaromatic Hydrocarbons

TPH = Total Petroleum Hydrocarbons (gasoline and diesel range)

VOC = Volatile Organic Compounds

<sup>1</sup> = Direct push refusal was encountered at the following soil broing locations: A01B01, A01B02, A01B05, A01B06, and A01B08.

**Table 23-2**  
**AOC 1 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01G01/SR1 3/13/1997 0 1 D97-3053-1	A01G01X/SR1 3/13/1997 0 1 D97-3053-1X SW846-8310	A01G02/SR1 3/13/1997 0 1 D97-3053-3	A01G02X/SR1 3/13/1997 0 1 D97-3053-3X SW846-8310	A01G03/SR1 3/13/1997 0 1 D97-3053-4	A01G03/SR1 3/13/1997 0 1 D97-3053-4R2 Reanalysis	A01G03X/SR1 3/13/1997 0 1 D97-3053-4X SW846-8310
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthene	mg/Kg	0.351 U	0.129 U	0.402 U	0.148 U	0.359 U	7.18 DU	0.132 U
Acenaphthylene	mg/Kg	0.351 U	0.214 U	0.402 U	0.245 U	0.359 U	7.18 DU	0.35
Anthracene	mg/Kg	0.351 U	0.184	0.402 U	0.184	0.359 U	7.18 DU	0.217
Benzo(a)anthracene	mg/Kg	0.552	0.506	0.402 U	0.394	0.359 U	7.18 DU	0.0254
Benzo(a)pyrene	mg/Kg	0.937	1.23	0.607	0.722	0.359 U	7.18 DU	0.0455
Benzo(b)fluoranthene	mg/Kg	1.93	1.5	1.26	1.11	0.359 U	7.18 DU	0.0718
Benzo(g,h,i)perylene	mg/kg	0.542	1.29	0.402 U	0.902	0.359 U	7.18 DU	0.0252 J
Benzo(k)fluoranthene	mg/Kg	0.632	0.727	0.471	0.463	0.359 U	7.18 DU	0.0124 U
Chrysene	mg/Kg	0.867	0.991	0.402 U	0.722	0.359 U	7.18 DU	0.156
Dibenzo(a,h)anthracene	mg/Kg	0.351 U	0.106	0.402 U	0.171	0.359 U	7.18 DU	0.0219 U
Fluoranthene	mg/Kg	0.548	1.29	0.585	1.23	0.359 U	7.18 DU	0.0145 J
Fluorene	mg/Kg	0.351 U	0.0239	0.402 U	0.0172 U	0.359 U	7.18 DU	0.0153 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.569	1.16	0.402 U	0.784	0.359 U	7.18 DU	0.0135 J
Naphthalene	mg/Kg	0.351 U	0.471	0.402 U	0.245 U	0.277 J	7.18 DU	0.219 U
Phenanthrene	mg/Kg	0.351 U	0.328	0.402 U	0.279	0.359 U	7.18 DU	0.0248 J
Pyrene	mg/Kg	0.874	1.18	0.811	0.927	0.359 U	7.18 DU	0.251
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>7.451</b>	<b>10.987</b>	<b>3.734</b>	<b>7.888</b>	<b>0.277</b>	<b>ND</b>	<b>1.195</b>

Endnote: Due to laboratory error, samples from Grids A-01G01 through A01G08 were analyzed for PAHs by both methods SW846-8270 and SW846-8310.

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-2**  
**AOC 1 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01G04/SR1 3/13/1997 0 1 D97-3053-5	A01G04X/SR1 3/13/1997 0 1 D97-3053-5X SW846-8310	A01G04/SR1D 3/13/1997 0 1 D97-3053-6 Duplicate	A01G04X/SR1D 3/13/1997 0 1 D97-3053-6X SW846-8310	A01G05/SR1 3/13/1997 0 1 D97-3053-7	A01G05X/SR1 3/13/1997 0 1 D97-3053-7X SW846-8310	A01G06/SR1 3/13/1997 0 1 D97-3053-8
Semivolatiles	UNITS							
Acenaphthene	mg/Kg	0.353 U	0.129 U	0.348 U	0.128 U	0.349 U	0.128 U	0.758
Acenaphthylene	mg/Kg	0.353 U	0.215 U	0.348 U	0.212 U	0.349 U	0.213 U	0.25 J
Anthracene	mg/Kg	0.353 U	0.0381 J	0.348 U	0.0259 J	0.349 U	0.0193 J	1.06
Benzo(a)anthracene	mg/Kg	0.235 J	0.132	0.348 U	0.135	0.349 U	0.14	1.87
Benzo(a)pyrene	mg/Kg	0.153 J	0.154	0.348 U	0.14	0.349 U	0.104	1.63
Benzo(b)fluoranthene	mg/Kg	0.387	0.233	0.348 U	0.198	0.349 U	0.163	3.59
Benzo(g,h,i)perylene	mg/kg	0.353 U	0.184	0.348 U	0.162	0.349 U	0.0577	0.569
Benzo(k)fluoranthene	mg/Kg	0.202 J	0.102	0.348 U	0.112	0.349 U	0.0846	1.51
Chrysene	mg/Kg	0.28 J	0.192	0.348 U	0.2	0.349 U	0.178	2.02
Dibenzo(a,h)anthracene	mg/Kg	0.353 U	0.038	0.348 U	0.0212 U	0.349 U	0.0231	0.363 U
Fluoranthene	mg/Kg	0.353 U	0.302	0.348 U	0.316	0.349 U	0.325	6.12
Fluorene	mg/Kg	0.353 U	0.0151 U	0.348 U	0.0149 U	0.349 U	0.0149 U	0.681
Indeno(1,2,3-cd)pyrene	mg/Kg	0.353 U	0.182	0.348 U	0.172	0.349 U	0.106	0.648
Naphthalene	mg/Kg	0.353 U	0.215 U	0.348 U	0.212 U	0.349 U	0.213 U	0.363 U
Phenanthrene	mg/Kg	0.353 U	0.105	0.348 U	0.118	0.349 U	0.0251 J	4.16
Pyrene	mg/Kg	0.505	0.274	0.348 U	0.278	0.349 U	0.259	6.1
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>1.762</b>	<b>1.936</b>	<b>ND</b>	<b>1.857</b>	<b>ND</b>	<b>1.485</b>	<b>30.966</b>

Endnote: Due to laboratory error, samples from Grids A-01G01 through A01G08 were analyzed for PAHs by both methods SW846-8270 and SW846-8310.

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-2**  
**AOC 1 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01G06X/SR1 3/13/1997 0 1 D97-3053-8X SW846-8310	A01G07/SR1 3/13/1997 0 1 D97-3053-9	A01G07X/SR1 3/13/1997 0 1 D97-3053-9X SW846-8310	A01G08/SR1 3/13/1997 0 1 D97-3053-12	A01G08X/SR1 3/13/1997 0 1 D97-3053-12X SW846-8310	A01G09/SR1 5/9/1997 0 1 D97-5737-1	A01G10/SR1 5/9/1997 0 1 D97-5737-2
Semivolatiles	UNITS							
Acenaphthene	mg/Kg	0.133 U	0.357 U	0.131 U	0.35 U	0.128 U	0.365 U	0.361 U
Acenaphthylene	mg/Kg	<b>0.874</b>	0.357 U	0.218 U	0.35 U	0.213 U	0.365 U	0.361 U
Anthracene	mg/Kg	<b>1.39</b>	<b>0.235 J</b>	<b>0.294</b>	0.35 U	<b>0.0166 J</b>	0.365 U	0.361 U
Benzo(a)anthracene	mg/Kg	<b>1.16</b>	<b>0.442</b>	<b>0.354</b>	0.35 U	<b>0.0899</b>	<b>0.741</b>	<b>0.239 J</b>
Benzo(a)pyrene	mg/Kg	<b>1.37</b>	<b>0.465</b>	<b>0.6</b>	0.35 U	<b>0.0824</b>	<b>0.886</b>	<b>0.298 J</b>
Benzo(b)fluoranthene	mg/Kg	<b>1.92</b>	<b>1.03</b>	<b>0.824</b>	0.35 U	<b>0.1</b>	<b>1.69</b>	<b>0.586</b>
Benzo(g,h,i)perylene	mg/kg	<b>1.28</b>	0.357 U	<b>0.504</b>	0.35 U	<b>0.0474 J</b>	<b>0.848</b>	<b>0.234 J</b>
Benzo(k)fluoranthene	mg/Kg	<b>0.991</b>	<b>0.403</b>	<b>0.553</b>	0.35 U	<b>0.0594</b>	<b>0.538</b>	<b>0.211 J</b>
Chrysene	mg/Kg	<b>1.7</b>	<b>0.577</b>	<b>0.639</b>	0.35 U	<b>0.125</b>	<b>0.982</b>	<b>0.348 J</b>
Dibenzo(a,h)anthracene	mg/Kg	<b>0.236</b>	0.357 U	<b>0.0328</b>	0.35 U	0.0213 U	0.365 U	0.361 U
Fluoranthene	mg/Kg	<b>6.45</b>	<b>0.65</b>	<b>1.39</b>	0.35 U	<b>0.236</b>	<b>0.657</b>	<b>0.311 J</b>
Fluorene	mg/Kg	<b>0.935</b>	0.357 U	<b>0.137</b>	0.35 U	<b>0.00471</b>	0.365 U	0.361 U
Indeno(1,2,3-cd)pyrene	mg/Kg	<b>1.12</b>	<b>0.199 J</b>	<b>0.475</b>	0.35 U	<b>0.16</b>	<b>0.656</b>	<b>0.191 J</b>
Naphthalene	mg/Kg	0.221 U	0.357 U	0.218 U	0.35 U	0.213 U	0.365 U	0.361 U
Phenanthrene	mg/Kg	<b>3.26</b>	<b>0.212 J</b>	<b>0.297</b>	0.35 U	<b>0.0646</b>	<b>0.283 J</b>	0.361 U
Pyrene	mg/Kg	<b>2.43</b>	<b>0.863</b>	<b>0.985</b>	0.35 U	<b>0.242</b>	<b>1.42</b>	<b>0.613</b>
Total Detected SVOCs	UNITS							
Total Semi-Volatiles	mg/Kg	<b>25.116</b>	<b>5.076</b>	<b>7.085</b>	ND	<b>1.228</b>	<b>8.701</b>	<b>3.031</b>

Endnote: Due to laboratory error, samples from Grids A-01G01 through A01G08 were analyzed for PAHs by both methods SW846-8270 and SW846-8310.

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-2**  
**AOC 1 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01G11/SR1 5/9/1997 0 1 D97-5737-3	A01G12/SR1 5/9/1997 0 1 D97-5737-4	A01G13/SR1 5/9/1997 0 1 D97-5737-5	A01G14/SR1 5/9/1997 0 1 D97-5737-6
<b>Semivolatiles</b>	<b>UNITS</b>				
Acenaphthene	mg/Kg	0.356 U	0.367 U	0.376 U	0.367 U
Acenaphthylene	mg/Kg	0.356 U	0.367 U	0.376 U	0.367 U
Anthracene	mg/Kg	0.356 U	0.367 U	0.376 U	0.367 U
Benzo(a)anthracene	mg/Kg	0.237 J	0.501	0.216 J	0.367 U
Benzo(a)pyrene	mg/Kg	0.321 J	0.531	0.214 J	0.367 U
Benzo(b)fluoranthene	mg/Kg	0.513	0.924	0.333 J	0.367 U
Benzo(g,h,i)perylene	mg/kg	0.344 J	0.393	0.166 J	0.367 U
Benzo(k)fluoranthene	mg/Kg	0.147 J	0.392	0.13 J	0.367 U
Chrysene	mg/Kg	0.345 J	0.628	0.284 J	0.367 U
Dibenzo(a,h)anthracene	mg/Kg	0.356 U	0.127 J	0.376 U	0.367 U
Fluoranthene	mg/Kg	0.282 J	0.603	0.289 J	0.367 U
Fluorene	mg/Kg	0.356 U	0.367 U	0.376 U	0.367 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.208 J	0.328 J	0.146 J	0.367 U
Naphthalene	mg/Kg	0.356 U	0.367 U	0.376 U	0.367 U
Phenanthrene	mg/Kg	0.175 J	0.254 J	0.194 J	0.367 U
Pyrene	mg/Kg	0.599	0.936	0.403	0.367 U
<b>Total Detected SVOCs</b>	<b>UNITS</b>				
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>3.171</b>	<b>5.617</b>	<b>2.375</b>	<b>ND</b>

Endnote: Due to laboratory error, samples from Grids A-01G01 through A01G08 were analyzed for PAHs by both methods SW846-8270 and SW846-8310.

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 23-3**  
**AOC 1 Phase 1 Direct-Push and Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01B03/DP1 3/25/1997 0 4 D97-3598-1	A01B03/DP2 3/25/1997 4 8 D97-3598-4	A01B03/DP3 3/25/1997 8 9 D97-3598-5	A01B04/DP1 3/25/1997 0 4 D97-3598-6	A01B04/DP2 3/25/1997 4 8 D97-3598-7	A01B04/DP3 3/25/1997 8 10 D97-3598-8	A01B07/DP1 3/26/1997 0 3 D97-3689-14
Semivolatiles	UNITS							
Acenaphthylene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Anthracene	mg/kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Benzo(a)anthracene	mg/kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Benzo(a)pyrene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Benzo(b)fluoranthene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.352 J	0.362 U	0.35 U
Benzo(g,h,i)perylene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Benzo(k)fluoranthene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.185 J	0.362 U	0.35 U
Chrysene	mg/Kg	0.708 U	0.39 U	0.381 U	0.202 J	0.216 J	0.362 U	0.35 U
Dibenzo(a,h)anthracene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Fluoranthene	mg/Kg	0.708 U	0.39 U	0.381 U	0.189 J	0.382 U	0.362 U	0.35 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Naphthalene	mg/Kg	0.708 U	0.39 U	0.381 U	0.349 U	0.382 U	0.362 U	0.35 U
Phenanthrene	mg/Kg	0.708 U	0.39 U	0.381 U	0.193 J	0.243 J	0.362 U	0.35 U
Pyrene	mg/Kg	0.293 J	0.39 U	0.381 U	0.285 J	0.382 U	0.362 U	0.35 U
Total Detected SVOCs	UNITS							
Total Semi-Volatiles	mg/Kg	0.293	ND	ND	0.869	0.996	ND	ND

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-3**  
**AOC 1 Phase 1 Direct-Push and Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01MW4/SB1 4/29/1997 0 4 D97-5313-5	A01MW4/SB1D 4/29/1997 0 4 D97-5313-6 Duplicate	A01MW4/SB2 4/29/1997 4 8 D97-5313-7	A01MW5/SB1 4/29/1997 0 4 D97-5313-1	A01MW5/SB2 4/29/1997 4 8 D97-5313-2	A01MW6/SB1 4/30/1997 0 4 D97-5313-9	A01MW6/SB2 4/30/1997 4 8 D97-5313-10
<b>Semivolatiles</b>	<b>UNITS</b>							
Acenaphthylene	mg/Kg	1.06 U	1.06 U	1.1 U	0.368 U	1.13 U	0.366 U	0.367 U
Anthracene	mg/kg	1.06 U	1.06 U	1.1 U	0.368 U	1.13 U	0.366 U	0.367 U
Benzo(a)anthracene	mg/kg	1.06 U	1.06 U	0.482 J	0.368 U	0.991 J	0.419	0.975
Benzo(a)pyrene	mg/Kg	1.06 U	1.06 U	1.26	0.368 U	1.77	0.421	1.48
Benzo(b)fluoranthene	mg/Kg	0.423 J	1.06 U	1.11	0.368 U	1.81	0.709	2.21
Benzo(g,h,i)perylene	mg/Kg	0.354 J	1.06 U	1.81	0.368 U	2.43	0.293 J	1.8
Benzo(k)fluoranthene	mg/Kg	1.06 U	1.06 U	0.411 J	0.368 U	1.13 U	0.371	0.692
Chrysene	mg/Kg	1.06 U	1.06 U	0.673 J	0.368 U	1.23	0.52	1.17
Dibenzo(a,h)anthracene	mg/Kg	1.06 U	1.06 U	0.816 J	0.368 U	1.05 J	0.366 U	0.516
Fluoranthene	mg/Kg	1.06 U	1.06 U	1.1 U	0.368 U	0.839 J	0.83	0.988
Indeno(1,2,3-cd)pyrene	mg/Kg	1.06 U	1.06 U	1.09 J	0.368 U	1.49	0.215 J	1.36
Naphthalene	mg/Kg	1.06 U	1.06 U	1.1 U	0.368 U	1.13 U	0.366 U	0.367 U
Phenanthrene	mg/Kg	1.06 U	0.336 J	1.1 U	0.368 U	0.68 J	0.295 J	0.478
Pyrene	mg/Kg	1.06 U	1.06 U	0.589 J	0.368 U	1.36	0.747	1.52
<b>Total Detected SVOCs</b>	<b>UNITS</b>							
<b>Total Semi-Volatiles</b>	<b>mg/Kg</b>	<b>0.777</b>	<b>0.336</b>	<b>8.241</b>	<b>ND</b>	<b>13.65</b>	<b>4.82</b>	<b>13.19</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-3**  
**AOC 1 Phase 1 Direct-Push and Soil Boring Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A01MW6/SB3 4/30/1997 8 10 D97-5313-11	A01MW7/SB1 4/29/1997 0 4 D97-5313-3	A01MW7/SB2 4/29/1997 4 8 D97-5313-4
Semivolatiles	UNITS			
Acenaphthylene	mg/Kg	0.415 U	0.347 U	1.11 U
Anthracene	mg/kg	0.415 U	0.347 U	1.11 U
Benzo(a)anthracene	mg/kg	0.415 U	0.127 J	0.409 J
Benzo(a)pyrene	mg/Kg	0.415 U	0.123 J	0.528 J
Benzo(b)fluoranthene	mg/Kg	0.234 J	0.183 J	0.747 J
Benzo(g,h,i)perylene	mg/Kg	0.286 J	0.158 J	0.577 J
Benzo(k)fluoranthene	mg/Kg	0.415 U	0.347 U	1.11 U
Chrysene	mg/Kg	0.308 J	0.182 J	0.62 J
Dibenzo(a,h)anthracene	mg/Kg	0.415 U	0.347 U	1.11 U
Fluoranthene	mg/Kg	0.415 U	0.189 J	0.57 J
Indeno(1,2,3-cd)pyrene	mg/Kg	0.415 U	0.347 U	0.459 J
Naphthalene	mg/Kg	0.415 U	0.347 U	1.11 U
Phenanthrene	mg/Kg	0.34 J	0.144 J	0.587 J
Pyrene	mg/Kg	0.346 J	0.238 J	0.771 J
Total Detected SVOCs	UNITS			
Total Semi-Volatiles	mg/Kg	1.51	1.344	5.268

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-4**  
**AOC 1 Phase 1 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		A01MW1/GW1 5/14/1997 D97-5891-7	A01MW2/GW1 5/14/1997 D97-5891-8	A01MW3/GW1 5/14/1997 D97-5891-9	A01MW4/GW1 5/12/1997 D97-5825-14	A01MW5/GW1 5/14/1997 D97-5891-1	A01MW5/GW1D 5/14/1997 D97-5891-2 Duplicate	A01MW6/GW1 5/14/1997 D97-5891-3
<b>Volatiles</b>	UNITS							
Acetone	ug/L	26.1 J	100 U	100 U	100 U	100 U	100 U	100 U
Vinyl acetate	ug/L	25.5 J	50 U	50 U	50 U	50 U	50 U	50 U
<b>Total Detected VOCs</b>	UNITS							
<b>Total Volatiles</b>	ug/L	51.6	ND	ND	ND	ND	ND	ND
<b>Semivolatiles</b>	UNITS							
Naphthalene	ug/L	10.3 U	10.4 U	10.4 U	10 U	10.5 U	11.1 U	9.7 J
<b>Total Detected SVOCs</b>	UNITS							
<b>Total Semi-Volatiles</b>	ug/L	ND	ND	ND	ND	ND	ND	9.7

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 23-4**  
**AOC 1 Phase 1 Monitoring Well Groundwater Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Laboratory Number: Sample Type:		A01MW7/GW1 5/14/1997 D97-5891-4	
<b>Volatiles</b>	<b>UNITS</b>		
Acetone	ug/L	100	U
Vinyl acetate	ug/L	50	U
<b>Total Detected VOCs</b>	<b>UNITS</b>		
Total Volatiles	ug/L	ND	
<b>Semivolatiles</b>	<b>UNITS</b>		
Naphthalene	ug/L	11	U
<b>Total Detected SVOCs</b>	<b>UNITS</b>		
Total Semi-Volatiles	ug/L	ND	

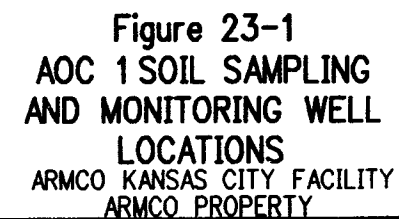
**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

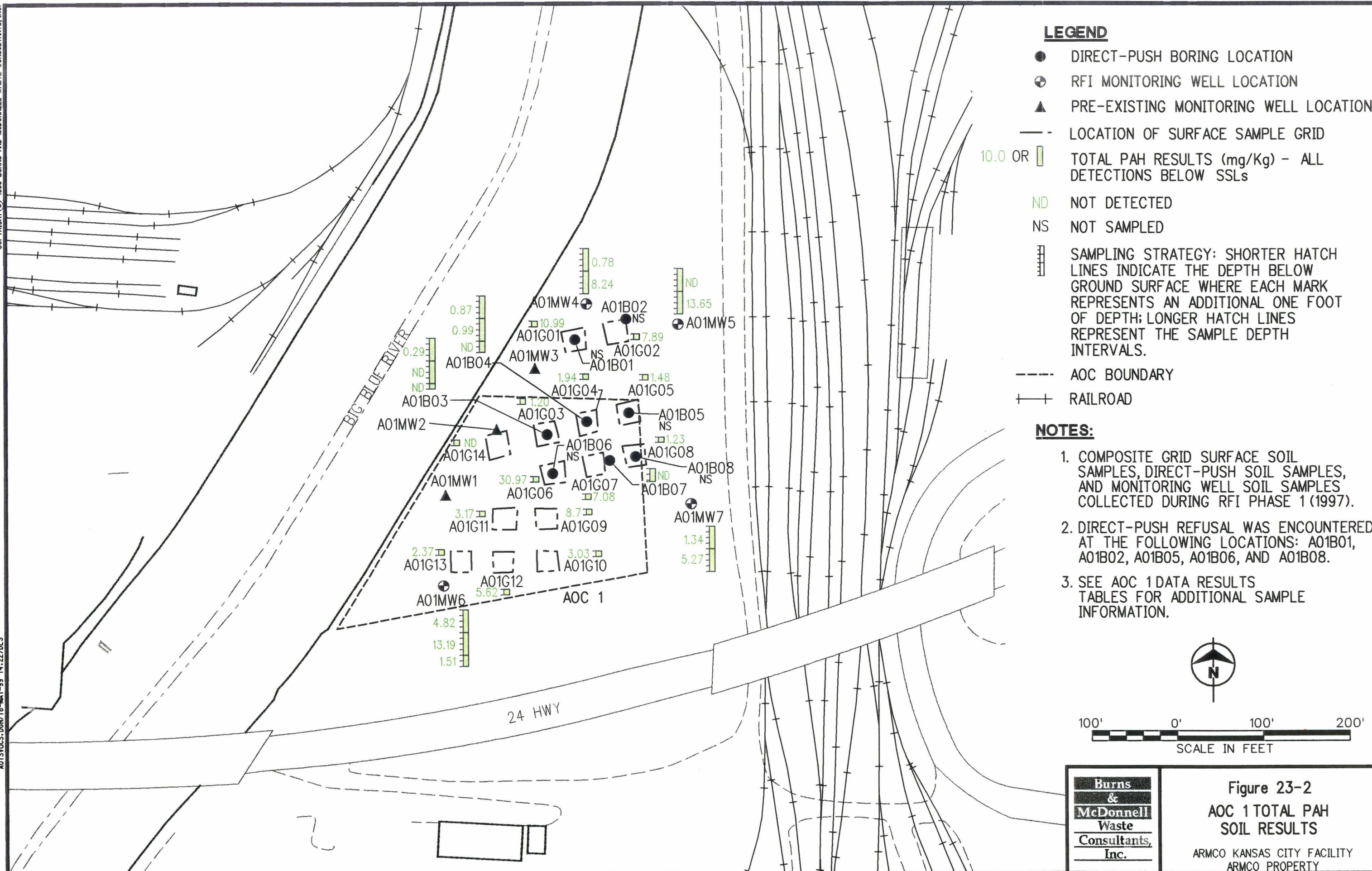
F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

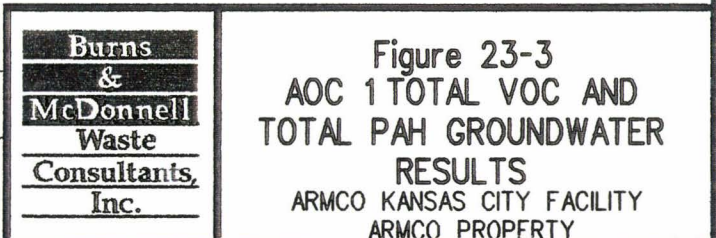
J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation











**AOC 8**

**"OWL GUN CLUB" SHOOTING PARK  
(ARMCO PROPERTY)**

## **24.0 AOC 8 – "OWL GUN CLUB" SHOOTING PARK**

### **24.1 AOC BACKGROUND**

#### **24.1.1 Description of AOC**

AOC 8, located on Armco property (see Figure 1-2), was a clay pigeon shooting park known as the "Owl Gun Club" which was located south of the Old Blue River "W" Landfill (SWMU 2) and immediately north of Rock Creek. Armco purchased the majority of the property in this area in 1957. The specific dates of operation of the Owl Gun Club are unknown. From a review of aerial photos, the AOC first becomes visible in 1955 and is no longer visible in 1974. Prior to utilization of the shooting range, the area was used for agriculture. Stationing posts and two trap buildings are visible on a 1955 aerial photograph. The western trap building is no longer present by 1964. By 1974, all evidence of the shooting range has been removed, and the area was again used for agriculture. A 1984 aerial photograph also indicates the former shooting range area was cultivated. Because little information is available about the dates the gun club was active or the amount of activity at the club, it is not possible to estimate how much lead shot might be present. The original defined AOC area was approximately 2.5 acres in size.

The primary constituent of potential concern associated with AOC 8 is lead from the lead shot utilized at the gun club.

#### **24.1.2 Release Potential**

Although no documented spills or releases are known to have occurred at this AOC, the nature of the activities resulted in a direct placement of lead shot onto the nearby surface soils. The primary release potential for this AOC was to the surrounding surface soil.

### **24.2 SCOPE OF ACTIVITIES COMPLETED**

Potential impact to the environment at AOC 8 was assessed through the collection of surface and shallow subsurface soil samples. Table 24-1 presents a summary of the investigation activities

completed for AOC 8 and Figure 24-1 shows the grid and boring locations at AOC 8. Based on new information obtained during RFI Phase 1 concerning the actual AOC location, grid and boring locations were moved approximately 200 feet north of the AOC boundary as defined in the RFI Workplan. The AOC boundary shown on Figures 24-1 and 24-2 reflects this adjustment.

Composite surface soil samples were collected from four grids (Grid A08G01 through A08G04) during RFI Phase 1. Grid samples were composites of five aliquot locations from within each grid, and were collected from 0 to 1 feet bgs. Due to the presence of an elevated lead detection at Grid A08G02, discrete (grab) samples were collected from each of the five original aliquot locations within that grid. During RFI Phase 1, four direct-push soil borings were advanced in the center of each surface soil grid, and samples were collected from 1 to 3 feet bgs. All samples were analyzed for lead.

During RFI Phase 2, XRF screening was used to aid in the characterization of soil samples in the field to more thoroughly define the extent of lead. Once the XRF screening indicated that the extent of lead had been defined, samples were sent to the analytical laboratory for confirmatory analysis. Selected samples from the impacted areas were also sent to the analytical laboratory for confirmatory analysis and to assist in the definition of the vertical extent of lead.

Soil samples were collected from an additional 44 direct-push borings (Borings A08B05 through A08B48) during RFI Phase 2. Two to three soil samples were collected from each boring, for a total of 125 samples. Samples were typically collected from the 0 to 1, 1 to 2, and/or 2 to 3 feet bgs depth intervals. Exceptions were made at Boring A08B11 where samples were collected from the 4 to 5, 5 to 6, and 6 to 7 feet bgs depth intervals, and A08B18 where samples were collected from the 4.5 to 5.5, 5.5 to 6.5, and 6.5 to 7.5 feet bgs depth intervals. These variations were due to wood chips and fill materials that were placed in the area subsequent to the shooting park, and sampling began at the depth of native soil. All samples from Borings A08B05 through A08B40 were initially screened for lead using XRF spectroscopy. A total of 109 of the samples from the 44 Phase 2 borings were subsequently sent to the analytical laboratory for lead analysis. In addition, ten of the samples from Borings A08B17, A08B23, A08B33, and A08B37 were analyzed for pH to obtain soil chemistry information.



AOC 8 is underlain by clays and silty to sandy clays typical of Missouri River floodplain sediments. A fill platform of slag material abuts AOC 8 to the northwest. Slag gravel roads also bound the western and southern margins of the site. The slag fill platform mentioned above has recently been utilized for the placement of mulched tree trimmings generated off-site and on-site.

### 24.3 NATURE AND EXTENT OF CONTAMINATION IN SOIL

Tables 24-2 and 24-3 present the analytical results for AOC 8. Figure 24-2 presents the lead soil results for AOC 8. XRF analysis results are presented in Appendix S.

Ten samples, from depths between 0 to 3 feet bgs, were analyzed for pH. Results ranged from pH 7.8 J\* to 8.9. No notable differences were found with varying depth or location, and results show a neutral to basic pH.

Lead was detected in all of the samples collected at AOC 8. Lead concentrations were below the 20 DAF SSL (400 mg/Kg) in approximately 75 percent of the samples sent to the analytical laboratory. Lead concentrations exceeded the 20 DAF SSL (400 mg/Kg) in 30 of the 122 samples analyzed and are presented in Table 24-4. The number of detections, number of 20 DAF SSL exceedences, and highest lead concentrations are summarized below by depth interval.

Analytical Laboratory Lead Results for AOC 8 by Depth							
Depth (ft)	Number of Samples	Number of Detections	Number of 20 DAF SSL Exceedences	Highest Detection (mg/Kg)	Location	Second Highest Detection (mg/Kg)	Location
0-1	51	51	22	45,600 DF	A08B10	40,400 DF	A08B06
1-2	42	42	6	55,200 J*	A08B48	39,100 DF	A08B06
1-3	4	4	0	191	A08B03	135	A08B02
2-3	20	20	1	778 DF	A08B07	61.1 DJ*	A08B16
4-5	2	2	1	11,200 DF	A08B11	59.1 DJ*	A08B18
5-6	2	2	0	19.6 DF	A08B11	8 DJ*	A08B18
6-7	1	1	0	10.6 DF	A08B11	--	--

As is apparent on Figure 24-2, the size of AOC 8 (based upon the area investigated) increased to encompass approximately 6 acres. The horizontal extent of contamination was well defined by



the borings around the perimeter of the area sampled, but shifted north of the initial AOC definition. In particular, borings around the perimeter of the impacted area generally had lead concentrations less than 100 mg/Kg.

The soil samples collected from the central portion of the AOC 8 area contained lead at varying (almost sporadic) concentrations. It is probable that the highest concentrations were due to discrete pellets of lead shot in the portion of the sample extracted and analyzed by the laboratory. Twelve samples showed lead concentrations in excess of 10,000 mg/Kg. These detections occurred throughout the central portion of the area sampled, with significantly lower concentrations typically encountered in nearby sample locations, or even within the same boring location or duplicate sample. For example, the sample collected in the 0 to 1 feet depth interval at Boring A08B10 contained 3,810 mg/Kg lead while its duplicate contained 45,600 mg/Kg lead. Similar discrepancies between original and duplicate results were noted at Boring A08B37.

As an example of the typical sporadic nature of the data, the lead concentration in the 0 to 1 feet interval at Boring A08B19 (in the central portion of the impacted area) was 1,770 mg/Kg while at Boring A08B42 (approximately 50 feet to the west) the concentration was 11,500 mg/Kg. Similarly, the lead concentration in the 0 to 1 feet interval at Boring A08B20 (also centrally located) was 3,000 mg/Kg, increased to 28,300 mg/Kg just 50 feet to the east (in Boring A08B21), and then decreased to 216 mg/Kg another 50 feet east (in Boring A08B26).

The majority of the 20 DAF SSL exceedences were noted in the 0 to 1 feet bgs depth interval, a few exceedences occurred in the 1 to 2 feet bgs depth interval, and one exceedence occurred in the 2 to 3 feet bgs depth interval. Therefore, for most borings, the vertical extent of lead was limited to the upper one or two feet of soil. An exception was noted at Boring A08B11 that contained a lead detection of 11,200 mg/Kg from 4 to 5 feet bgs. As previously indicated in Section 24.2, samples were collected beginning at 4 to 5 feet bgs when native soil was encountered below the fill material. The location is potentially a low point in the surrounding topography that has been filled during the intervening years with miscellaneous materials (primarily wood chips). The vertical extent of lead was defined in this boring by the deeper samples (19.6 DF mg/Kg and 10.6 DF mg/Kg at 5 to 6 and 6 to 7 feet bgs, respectively).

## **24.4 FATE AND TRANSPORT POTENTIAL**

Potential migration pathways for AOC 8, as summarized in Table 3-1 include subsurface pathways (soil transfer to groundwater and groundwater transport), the surface pathway (storm water runoff), and the air pathway (airborne dust).

The nature and extent of contamination at AOC 8 was assessed through the collection of surface soil and subsurface soil samples. Lead was detected throughout AOC 8 at concentrations exceeding 20 DAF SSLs (based on soil migration to groundwater), from the surface to typically depths of 2 or 3 feet bgs. At one sampling location, lead exceedences occurred to a depth of 5 feet bgs (approximate elevation 724 feet above MSL). Therefore, soil transfer to groundwater could occur. The tendency for metals to strongly adsorb to soil and the neutral to slightly basic soil pH (7.8 to 8.9) at AOC 8 are expected to limit vertical migration of lead.

Groundwater was not encountered at AOC 8 during subsurface soil sampling activities and groundwater samples were not collected. At SWMU 2 located just north of AOC 8, the saturated zone was typically encountered at approximate elevations 719 (shallowest) to 711 (deepest) feet above MSL. Based on the vertical definition of lead in subsurface soil at depths shallower than the saturated zone, a groundwater transport pathway is not expected to be significant for AOC 8.

AOC 8 is a vegetated area. Storm water ponds and infiltrates in the immediate AOC area. Thus, storm water runoff should not provide a significant route for constituent migration. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. However, based on the size of the lead shot in the soil and the vegetative surface cover, dust migration via the air pathway is not expected to be significant at AOC 8.

## **24.5 RISK EVALUATION**

A risk evaluation for the Facility was conducted (see Appendices X and Y). The following subsections provide a summary of specific risk evaluation conducted at AOC 8.

#### **24.5.1 Human Health Evaluation**

Lead was identified as a COPC in both surface and subsurface soil. Lead modeling was conducted for AOC 8 to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. For the exposure scenarios evaluated, it was determined that lead in soil at AOC 8 may pose an unacceptable level of risk for the full-time pregnant female worker scenario. However, lead in soil did not pose significant risk for the generic full-time worker or the temporary excavation worker scenarios. The results of the lead modeling and risk evaluation are presented in Chapter 5.0 of Appendix X.

#### **24.5.2 Ecological Evaluation**

Lead was identified as a COPEC at AOC 8. Lead exceeded the preliminary screening for plant, soil organism, and wildlife receptors. Five wildlife species exceeded the benchmarks used in site-specific screening in surface soil. The preliminary and site-specific screening indicate possible negative impact to various ecological receptors. However, based on the RFI field activities and a field site visit in October 1998, the ecological receptors present at AOC 8 did not exhibit signs of lead toxicity. The effects of lead on potential receptors are dependent on the bioavailability of lead. Since the soil pH in this area is neutral to slightly basic, lead is probably not in soluble (bioavailable) form. Therefore, the lead contamination at AOC 8 is not anticipated to pose risk to potential ecological receptors. Details of the ecological risk evaluation for AOC 8 are provided in Chapter 4.0 of Appendix Y.

### **24.6 SUMMARY**

AOC 8, located in the eastern portion of the Facility, was an area utilized as a clay pigeon shooting park. The original defined AOC area was approximately 2.5 acres in size. The AOC 8 area was expanded in size, primarily to the north, during the investigation to approximately 6 acres in size in order to define the nature and extent of contamination. Surface soil and subsurface soil samples were collected at AOC 8.

As shown on Figure 24-2, the horizontal and vertical extent of contamination at AOC 8 were adequately defined by the 122 surface and subsurface soil samples. The horizontal extent of

contamination was well defined by borings on the perimeter of the AOC 8 area, but shifted north of the initial AOC definition. In particular, borings around the perimeter of the impacted area generally had lead concentrations less than 100 mg/Kg. Concentrations of lead in soil samples throughout the central portion of the sampling area varied significantly, ranging from concentrations just above the 20 DAF SSL of 400 mg/kg to concentrations as high as 55,200 mg/Kg. The sporadic nature of the data is attributed to some samples containing actual lead shot, while others may not have contained this material. All but two of the 20 DAF SSL exceedences (and thus the vertical extent of contamination) were limited to the upper two feet of the soil. In the west-central portion of the sampling area, an exception was noted at Boring A08B11 that was located in an area of fill material and contained a lead detection of 11,200 mg/Kg from 4 to 5 feet bgs. Ten samples were also analyzed for pH, which was neutral to basic (pH 7.8 J\* to pH 8.9).

Potential migration pathways at AOC 8 include soil transfer to groundwater, groundwater transport, storm water runoff, and airborne dust migration.). Lead was detected throughout AOC 8 at concentrations exceeding 20 DAF SSLs (based on soil migration to groundwater), from the surface to as deep as 5 feet bgs (approximate elevation 724 feet above MSL). Therefore, soil transfer to groundwater could occur. The tendency for metals to strongly adsorb to soil and the neutral to basic pH of the soil at AOC 8 are expected to limit vertical migration of metals. Groundwater was not encountered during subsurface soil sampling and groundwater samples were not collected. The saturated zone, as encountered to the north at SWMU 2, is expected to be approximately 5 feet or deeper below the deepest soil detections above 20 DAF SSLs. Based on the definition of the vertical extent of lead in soil at shallower depths above the saturated zone, and the tendencies for metals to strongly adsorb to soil rather than migrate with groundwater movement, the groundwater transport pathway is not expected to be significant for AOC 8.

Storm water ponds and infiltrates in the immediate AOC area; therefore, storm water runoff should not provide a significant route for constituent migration. Surface soil particulate (dust) could become airborne. The prevailing wind direction at the Facility is from the south-southwest to the north-northeast. However, based on the size of the lead shot in the soil and the vegetative surface cover, dust migration via the air pathway is not expected to be significant at AOC 8.

A risk evaluation was conducted for AOC 8. For the human health evaluation, lead was identified as a COPC in surface and subsurface soil. Therefore, lead modeling was conducted to evaluate potential health risks to possible future on-site worker populations including full-time workers and temporary excavation workers. It was determined that lead in soil may pose an unacceptable level of risk for the full-time pregnant female worker scenario. However, lead in soil did not pose significant risk for the full-time generic worker or the temporary excavation worker scenarios. An ecological evaluation was also conducted for AOC 8. Lead exceeded both preliminary (benchmark) and site-specific screening for various plant and wildlife receptors. Qualitative factors and field site visits both indicate that lead contamination is not eliciting adverse effects on these receptors, and as such, risk to potential ecological receptors is not expected to be significant.

\* \* \* \* \*

**Table 24-1**  
**AOC 8 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis Lead	pH	Comments	Lab ID Number
Point	Designator								
<b>DIRECT-PUSH SOIL SAMPLES</b>									
A08B01	DP1	1 - 3	3/17/97	1		X		Field Duplicate	D97-3187-1
	DP1D	1 - 3	3/17/97	1		X			D97-3187-2
A08B02	DP1	1 - 3	3/17/97	1		X		Matrix Spike Matrix Spike Duplicate	D97-3187-3
	DP1MS	1 - 3	3/17/97	1		X			D97-3187-4
	DP1MSD	1 - 3	3/17/97	1		X			D97-3187-5
A08B03	DP1	1 - 3	3/17/97	1		X			D97-3187-6
A08B04	DP1	1 - 3	3/17/97	1		X			D97-3187-7
	DP1R		3/17/97	1		X			D97-3187-8
A08B05	DP1	0 - 1	6/1/98	2	X	X		Matrix Spike Matrix Spike Duplicate Rinsate	D98-4319-1
	DP1MS	0 - 1	6/1/98	2	X	X			D98-4319-2
	DP1MSD	0 - 1	6/1/98	2	X	X			D98-4319-3
	DP1R		6/1/98	2	X	X			D98-4166-15
	DP2	1 - 2	6/1/98	2	X	X			D98-4319-4
	DP3	2 - 3	6/1/98	2	X	X			D98-4319-5
A08B06	DP1	0 - 1	6/1/98	2	X	X		Field Duplicate	D98-4319-6
	DP2	1 - 2	6/1/98	2	X	X			D98-4319-7
	DP3	2 - 3	6/1/98	2	X	X			D98-4319-8
	DP3D	2 - 3	6/1/98	2	X	X			D98-4319-9
A08B07	DP1	0 - 1	6/1/98	2	X	X			D98-4319-10
	DP2	1 - 2	6/1/98	2	X	X			D98-4319-11
	DP3	2 - 3	6/1/98	2	X	X			D98-4319-12
A08B08	DP1	0 - 1	6/3/98	2	X	X			D98-4319-13
	DP2	1 - 2	6/3/98	2	X	X			D98-4319-14
	DP3	2 - 3	6/3/98	2	X				
A08B09	DP1	0 - 1	6/3/98	2	X	X		Matrix Spike Matrix Spike Duplicate	D98-4319-15
	DP2	1 - 2	6/3/98	2	X	X			D98-4319-16
	DP2MS	1 - 2	6/3/98	2	X	X			D98-4319-17
	DP2MSD	1 - 2	6/3/98	2	X	X			D98-4319-18
	DP3	2 - 3	6/3/98	2	X	X			D98-4319-19
A08B10	DP1	0 - 1	6/3/98	2	X	X		Field Duplicate	D98-4319-20
	DP1D	0 - 1	6/3/98	2	X	X			D98-4319-21
	DP2	1 - 2	6/3/98	2	X	X			D98-4319-22
	DP3	2 - 3	6/3/98	2	X	X			D98-4319-23
A08B11	DP1	4 - 5	6/3/98	2	X	X		Rinsate	D98-4319-24
	DP1R		6/3/98	2		X			D98-4166-16
	DP2	5 - 6	6/3/98	2	X	X			D98-4319-25
	DP3	6 - 7	6/3/98	2	X	X			D98-4319-26
A08B12	DP1	0 - 1	6/3/98	2	X	X			D98-4319-27
	DP2	1 - 2	6/3/98	2	X	X			D98-4319-28
	DP3	2 - 3	6/3/98	2	X				
A08B13	DP1	0 - 1	6/4/98	2	X	X			D98-4319-29
	DP2	1 - 2	6/4/98	2	X	X			D98-4319-30
	DP3	2 - 3	6/4/98	2	X				
A08B14	DP1	0 - 1	6/4/98	2	X	X		Field Duplicate	D98-4319-31
	DP2	1 - 2	6/4/98	2	X	X			D98-4319-32
	DP2D	1 - 2	6/4/98	2	X	X			D98-4319-33
	DP3	2 - 3	6/4/98	2	X	X			D98-43



**Table 24-1**  
**AOC 8 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis Lead	pH	Comments	Lab ID Number
Point	Designator								
A08B17	DP1	0 - 1	6/4/98	2	X	X	X		D98-4290-6
	DP2	1 - 2	6/4/98	2	X	X	X		D98-4290-7
	DP3	2 - 3	6/4/98	2	X				
A08B18	DP1	4.5 - 5.5	6/4/98	2	X	X			D98-4290-8
	DP2	5.5 - 6.5	6/4/98	2	X	X			D98-4290-9
	DP3	6.5 - 7.5	6/4/98	2	X				
A08B19	DP1	0 - 1	6/5/98	2	X	X			D98-4290-10
	DP2	1 - 2	6/5/98	2	X	X			D98-4290-11
	DP3	2 - 3	6/5/98	2	X				
A08B20	DP1	0 - 1	6/5/98	2	X	X		Field Duplicate	D98-4290-12
	DP2	1 - 2	6/5/98	2	X	X			D98-4290-13
	DP2D	1 - 2	6/5/98	2	X	X			D98-4290-14
	DP3	2 - 3	6/5/98	2	X	X			D98-4290-15
A08B21	DP1	0 - 1	6/5/98	2	X	X		Matrix Spike Matrix Spike Duplicate	D98-4290-16
	DP2	1 - 2	6/5/98	2	X	X			D98-4290-17
	DP3	2 - 3	6/5/98	2	X	X			D98-4290-18
	DP3MS	2 - 3	6/5/98	2	X	X			D98-4290-19
	DP3MSD	2 - 3	6/5/98	2	X	X			D98-4290-20
A08B22	DP1	0 - 1	6/5/98	2	X	X			D98-4344-1
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-2
	DP3	2 - 3	6/5/98	2	X	X			D98-4344-3
A08B23	DP1	0 - 1	6/5/98	2	X	X	X		D98-4344-4
	DP2	1 - 2	6/5/98	2	X	X	X		D98-4344-5
	DP3	2 - 3	6/5/98	2	X	X	X		D98-4344-6
A08B24	DP1	0 - 1	6/5/98	2	X	X			D98-4344-7
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-8
	DP3	2 - 3	6/5/98	2	X				
A08B25	DP1	0 - 1	6/5/98	2	X	X			D98-4344-9
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-10
	DP3	2 - 3	6/5/98	2	X				
A08B26	DP1	0 - 1	6/5/98	2	X	X			D98-4344-11
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-12
	DP3	2 - 3	6/5/98	2	X	X			D98-4344-13
A08B27	DP1	0 - 1	6/5/98	2	X	X		Field Duplicate Rinsate	D98-4344-14
	DP1D	0 - 1	6/5/98	2	X	X			D98-4344-15
	DP1R		6/5/98	2	X	X			D98-4202-1
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-16
	DP3	2 - 3	6/5/98	2	X				
A08B28	DP1	0 - 1	6/5/98	2	X	X			D98-4344-17
	DP2	1 - 2	6/5/98	2	X	X			D98-4344-18
	DP3	2 - 3	6/5/98	2	X	X			D98-4344-19
A08B29	DP1	0 - 1	6/5/98	2	X	X		Matrix Spike Matrix Spike Duplicate	D98-4344-20
	DP1MS	0 - 1	6/5/98	2	X	X			D98-4344-21
	DP1MSD	0 - 1	6/5/98	2	X	X			D98-4344-22
	DP2	1 - 2	6/5/98	2	X	X			D98-4290-21
	DP3	2 - 3	6/5/98	2	X	X			D98-4290-22
A08B30	DP1	0 - 1	6/9/98	2	X	X		Field Duplicate	D98-4290-23
	DP1D	0 - 1	6/9/98	2	X	X			D98-4290-24
	DP2	1 - 2	6/9/98	2	X	X			D98-4290-25
	DP3	2 - 3	6/9/98	2	X	X			D98-4290-26
A08B31	DP1	0 - 1	6/9/98	2	X	X			D98-4290-27
	DP2	1 - 2	6/9/98	2	X	X			D98-4290-28
	DP3	2 - 3	6/9/98	2	X	X			D98-4290-29

**Table 24-1**  
**AOC 8 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis Lead	pH	Comments	Lab ID Number
Point	Designator								
A08B32	DP1	0 - 1	6/9/98	2	X	X		Matrix Spike Matrix Spike Duplicate	D98-4290-30
	DP1MS	0 - 1	6/9/98	2	X	X			D98-4290-31
	DP1MSD	0 - 1	6/9/98	2	X	X			D98-4290-32
	DP2	1 - 2	6/9/98	2	X	X			D98-4290-33
	DP3	2 - 3	6/9/98	2	X				
A08B33	DP1	0 - 1	6/9/98	2	X	X	X		D98-4290-34
	DP2	1 - 2	6/9/98	2	X	X	X		D98-4290-35
	DP3	2 - 3	6/9/98	2	X				
A08B34	DP1	0 - 1	6/9/98	2	X	X			D98-4343-1
	DP2	1 - 2	6/9/98	2	X	X			D98-4343-2
	DP3	2 - 3	6/9/98	2	X				
A08B35	DP1	0 - 1	6/9/98	2	X	X			D98-4343-3
	DP2	1 - 2	6/9/98	2	X	X			D98-4343-4
	DP3	2 - 3	6/9/98	2	X	X			D98-4343-5
A08B36	DP1	0 - 1	6/9/98	2	X	X			D98-4343-6
	DP2	1 - 2	6/9/98	2	X	X			D98-4343-7
	DP3	2 - 3	6/9/98	2	X				
A08B37	DP1	0 - 1	6/10/98	2	X	X	X	Field Duplicate	D98-4343-8
	DP1D	0 - 1	6/10/98	2	X	X	X		D98-4343-9
	DP2	1 - 2	6/10/98	2	X	X	X		D98-4343-10
	DP3	2 - 3	6/10/98	2	X	X	X		D98-4343-11
A08B38	DP1	0 - 1	6/10/98	2	X	X		Matrix Spike Matrix Spike Duplicate	D98-4343-12
	DP1MS	0 - 1	6/10/98	2	X	X			D98-4343-13
	DP1MSD	0 - 1	6/10/98	2	X	X			D98-4343-14
	DP2	1 - 2	6/10/98	2	X	X			D98-4343-15
	DP3	2 - 3	6/10/98	2	X				
A08B39	DP1	0 - 1	6/10/98	2	X	X			D98-4343-16
	DP2	1 - 2	6/10/98	2	X	X			D98-4343-17
	DP3	2 - 3	6/10/98	2	X	X			
A08B40	DP1	0 - 1	6/10/98	2	X	X			D98-4343-18
	DP2	1 - 2	6/10/98	2	X	X			D98-4343-19
	DP3	2 - 3	6/10/98	2	X				
A08B41	DP1	0 - 1	8/24/98	2		X			363831
	DP2	1 - 2	8/24/98	2		X			363832
A08B42	DP1	0 - 1	8/24/98	2		X			363829
	DP2	1 - 2	8/24/98	2		X			363830
A08B43	DP1	0 - 1	8/24/98	2		X			363827
	DP2	1 - 2	8/24/98	2		X			363828
A08B44	DP1	0 - 1	8/24/98	2		X			363825
	DP2	1 - 2	8/24/98	2		X			363826
A08B45	DP1	0 - 1	8/24/98	2		X		Matrix Spike Matrix Spike Duplicate Rinsate Field Duplicate	363822
	DP1MS	0 - 1	8/24/98	2		X			363822MS
	DP1MSD	0 - 1	8/24/98	2		X			363822DP
	DP1R		8/24/98	2		X			363833
	DP2	1 - 2	8/24/98	2		X			363823
	DP2D	1 - 2	8/24/98	2		X			363824
A08B46	DP1	0 - 1	8/24/98	2		X			363820
	DP2	1 - 2	8/24/98	2		X			363821
A08B47	DP1	0 - 1	8/24/98	2		X			363818
	DP2	1 - 2	8/24/98	2		X			363819
A08B48	DP1	0 - 1	8/24/98	2		X			363815
	DP2	1 - 2	8/24/98	2		X			363816
	DP3	2 - 3	8/24/98	2		X			363817

**Table 24-1**  
**AOC 8 Investigation Activities**  
**Armco Kansas City Facility**

Sample Location		Depth of Sample (ft)	Date Collected	RFI Phase	Field XRF Lead	Chemical Analysis Lead	pH	Comments	Lab ID Number
Point	Designator								
COMPOSITE SURFACE SOIL GRIDS									
A08G01	SR1	0 - 1	3/12/97	1		X		Rinsate	D97-3022-1
	SR1R		3/12/97	1		X			D97-3022-2
A08G02	SR1	0 - 1	3/12/97	1		X		Field Duplicate	D97-3022-3
	SR1D	0 - 1	3/12/97	1		X			D97-3022-4
A08G02A	SR1	0 - 1	5/8/97	1		X			D97-5659-3
A08G02B	SR1	0 - 1	5/8/97	1		X			D97-5659-4
A08G02C	SR1	0 - 1	5/8/97	1		X			D97-5659-2
A08G02D	SR1	0 - 1	5/8/97	1		X			D97-5659-1
A08G02E	SR1	0 - 1	5/8/97	1		X			D97-5659-5
A08G03	SR1	0 - 1	3/12/97	1		X		Matrix Spike Matrix Spike Duplicate	D97-3022-5
	SR1MS	0 - 1	3/12/97	1		X			D97-3022-6
	SR1MSD	0 - 1	3/12/97	1		X			D97-3022-7
A08G04	SR1	0 - 1	3/12/97	1		X			D97-3022-8

**Notes:**

ft = feet

XRF = X-Ray Fluorescence Spectroscopy

**Table 24-2**  
**AOC 8 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08G01/SR1	A08G02/SR1	A08G02/SR1D	A08G02A/SR1	A08G02B/SR1	A08G02C/SR1	A08G02D/SR1
Date Sampled:		03/12/1997	03/12/1997	03/12/1997	05/08/1997	05/08/1997	05/08/1997	05/08/1997
Sample Depth From:		0	0	0	0	0	0	0
Sample Depth To:		1	1	1	1	1	1	1
Laboratory Number:		D97-3022-1	D97-3022-3	D97-3022-4	D97-5659-3	D97-5659-4	D97-5659-2	D97-5659-1
Sample Type:				Duplicate				
<b>Metals, Total</b>	<b>UNITS</b>							
<b>Lead, Total</b>	<b>mg/Kg</b>	<b>66.1 F</b>	<b>699 F</b>	<b>9,510 F</b>	<b>757</b>	<b>711</b>	<b>11.2 J</b>	<b>16.6</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-2**  
**AOC 8 Phase 1 Composite Surface Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08G02E/SR1	A08G03/SR1	A08G04/SR1
Date Sampled:		05/08/1997	03/12/1997	03/12/1997
Sample Depth From:		0	0	0
Sample Depth To:		1	1	1
Laboratory Number:		D97-5659-5	D97-3022-5	D97-3022-8
Sample Type:				
<b>Metals, Total</b>	<b>UNITS</b>			
Lead, Total	mg/Kg	<b>460</b>	<b>65.7 F</b>	<b>45.4 F</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B01/DP1 03/17/1997 1 3 D97-3187-1	A08B01/DP1D 03/17/1997 1 3 D97-3187-2 Duplicate	A08B02/DP1 03/17/1997 1 3 D97-3187-3	A08B03/DP1 03/17/1997 1 3 D97-3187-6	A08B04/DP1 03/17/1997 1 3 D97-3187-7	A08B05/DP1 06/01/1998 0 1 D98-4319-1	A08B05/DP2 06/01/1998 1 2 D98-4319-4
Metals, Total	UNITS							
Lead, Total	mg/Kg	24.5	23.2	135	191	25	3,420 DF	40.2 DF
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:	A08B05/DP3	A08B06/DP1	A08B06/DP2	A08B06/DP3	A08B06/DP3D	A08B07/DP1	A08B07/DP2	
Date Sampled:	06/01/1998	06/01/1998	06/01/1998	06/01/1998	06/01/1998	06/01/1998	06/01/1998	
Sample Depth From:	2	0	1	2	2	0	1	
Sample Depth To:	3	1	2	3	3	1	2	
Laboratory Number:	D98-4319-5	D98-4319-6	D98-4319-7	D98-4319-8	D98-4319-9	D98-4319-10	D98-4319-11	
Sample Type:					Duplicate			
Metals, Total	UNITS							
Lead, Total	mg/Kg	31.8 DF	40,400 DF	39,100 DF	56 DF	30.4 DF	29.1 DF	27,200 DF
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B07/DP3	A08B08/DP1	A08B08/DP2	A08B09/DP1	A08B09/DP2	A08B09/DP3	A08B10/DP1
Date Sampled:		06/01/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998
Sample Depth From:		2	0	1	0	1	2	0
Sample Depth To:		3	1	2	1	2	3	1
Laboratory Number:		D98-4319-12	D98-4319-13	D98-4319-14	D98-4319-15	D98-4319-16	D98-4319-19	D98-4319-20
Sample Type:								
Metals, Total	UNITS							
Lead, Total	mg/Kg	778 DF	27.5 DF	8.7 DF	1,950 DF	24.4 DF	24.8 DF	3,810 DF
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B10/DP1D	A08B10/DP2	A08B10/DP3	A08B11/DP1	A08B11/DP2	A08B11/DP3	A08B12/DP1
Date Sampled:		06/03/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998	06/03/1998
Sample Depth From:		0	1	2	4	5	6	0
Sample Depth To:		1	2	3	5	6	7	1
Laboratory Number:		D98-4319-21	D98-4319-22	D98-4319-23	D98-4319-24	D98-4319-25	D98-4319-26	D98-4319-27
Sample Type:		Duplicate						
Metals, Total	UNITS							
Lead, Total	mg/Kg	45,600 DF	55.7 DF	16.7 DF	11,200 DF	19.6 DF	10.6 DF	12.4 DF
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:	A08B12/DP2	A08B13/DP1	A08B13/DP2	A08B14/DP1	A08B14/DP2	A08B14/DP2D	A08B14/DP3
Date Sampled:	06/03/1998	06/04/1998	06/04/1998	06/04/1998	06/04/1998	06/04/1998	06/04/1998
Sample Depth From:	1	0	1	0	1	1	2
Sample Depth To:	2	1	2	1	2	2	3
Laboratory Number:	D98-4319-28	D98-4319-29	D98-4319-30	D98-4319-31	D98-4319-32	D98-4319-33	D98-4319-34
Sample Type:						Duplicate	
Metals, Total	UNITS						
Lead, Total	mg/Kg	9.5 DF	494 DF	24 DF	32,500 DF	86.7 DF	40.3 DF
Physical Properties of Soil	UNITS						
pH	SU	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B15/DP1 06/04/1998 0 1 D98-4290-1	A08B15/DP2 06/04/1998 1 2 D98-4290-2	A08B15/DP3 06/04/1998 2 3 D98-4290-3	A08B16/DP2 06/04/1998 1 2 D98-4290-4	A08B16/DP3 06/04/1998 2 3 D98-4290-5	A08B17/DP1 06/04/1998 0 1 D98-4290-6	A08B17/DP2 06/04/1998 1 2 D98-4290-7
<b>Metals, Total</b>	<b>UNITS</b>							
<b>Lead, Total</b>	<b>mg/Kg</b>	<b>10,200 DJ*</b>	<b>39.9 DJ*</b>	<b>9.1 DJ*</b>	<b>1,020 DJ*</b>	<b>61.1 DJ*</b>	<b>15.6 DJ*</b>	<b>8.3 DJ*</b>
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
<b>pH</b>	<b>SU</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>8.5 J*</b>	<b>8.5 J*</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B18/DP1 06/04/1998 4.5 5.5 D98-4290-8	A08B18/DP2 06/04/1998 5.5 6.5 D98-4290-9	A08B19/DP1 06/05/1998 0 1 D98-4290-10	A08B19/DP2 06/05/1998 1 2 D98-4290-11	A08B20/DP1 06/05/1998 0 1 D98-4290-12	A08B20/DP2 06/05/1998 1 2 D98-4290-13	A08B20/DP2D 06/05/1998 1 2 D98-4290-14 Duplicate
Metals, Total	UNITS							
Lead, Total	mg/Kg	59.1 DJ*	8 DJ*	1,770 DJ*	62.3 DJ*	3,000 DJ*	23.3 DJ*	47.9 DJ*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B20/DP3	A08B21/DP1	A08B21/DP2	A08B21/DP3	A08B22/DP1	A08B22/DP2	A08B22/DP3
Date Sampled:		06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998
Sample Depth From:		2	0	1	2	0	1	2
Sample Depth To:		3	1	2	3	1	2	3
Laboratory Number:		D98-4290-15	D98-4290-16	D98-4290-17	D98-4290-18	D98-4344-1	D98-4344-2	D98-4344-3
Sample Type:								
Metals, Total	UNITS							
Lead, Total	mg/Kg	11.8 DJ*	28,300 DJ*	59.8 DJ*	22.3 DJ*	1,910 DJ*	15.8 DJ*	16.7 DJ*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B23/DP1	A08B23/DP2	A08B23/DP3	A08B24/DP1	A08B24/DP2	A08B25/DP1	A08B25/DP2
Date Sampled:		06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998
Sample Depth From:		0	1	2	0	1	0	1
Sample Depth To:		1	2	3	1	2	1	2
Laboratory Number:		D98-4344-4	D98-4344-5	D98-4344-6	D98-4344-7	D98-4344-8	D98-4344-9	D98-4344-10
Sample Type:								
Metals, Total	UNITS							
Lead, Total	mg/Kg	25,500 DJ*	42.7 DJ*	17.2 DJ*	64.5 DJ*	13.1 DJ*	39 DJ*	20.6 DJ*
Physical Properties of Soil	UNITS							
pH	SU	7.8 J*	8 J*	8.2 J*	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B26/DP1	A08B26/DP2	A08B26/DP3	A08B27/DP1	A08B27/DP1D	A08B27/DP2	A08B28/DP1
Date Sampled:		06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998
Sample Depth From:		0	1	2	0	0	1	0
Sample Depth To:		1	2	3	1	1	2	1
Laboratory Number:		D98-4344-11	D98-4344-12	D98-4344-13	D98-4344-14	D98-4344-15	D98-4344-16	D98-4344-17
Sample Type:						Duplicate		
Metals, Total	UNITS							
Lead, Total	mg/Kg	216 DJ*	18.3 DJ*	18.1 DJ*	67.9 DJ*	82.9 DJ*	16.3 DJ*	314 DJ*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B28/DP2	A08B28/DP3	A08B29/DP1	A08B29/DP2	A08B29/DP3	A08B30/DP1	A08B30/DP1D
Date Sampled:		06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/05/1998	06/09/1998	06/09/1998
Sample Depth From:		1	2	0	1	2	0	0
Sample Depth To:		2	3	1	2	3	1	1
Laboratory Number:		D98-4344-18	D98-4344-19	D98-4344-20	D98-4290-21	D98-4290-22	D98-4344-23	D98-4344-24
Sample Type:								Duplicate
Metals, Total	UNITS							
Lead, Total	mg/Kg	21.6 DJ*	14.2 DJ*	939 DJ*	35,200 DJ*	50 DJ*	6,190 DJ*	3,800 DJ*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B30/DP2 06/09/1998 1 2 D98-4344-25	A08B30/DP3 06/09/1998 2 3 D98-4344-26	A08B31/DP1 06/09/1998 0 1 D98-4344-27	A08B31/DP2 06/09/1998 1 2 D98-4344-28	A08B31/DP3 06/09/1998 2 3 D98-4344-29	A08B32/DP1 06/09/1998 0 1 D98-4344-30	A08B32/DP2 06/09/1998 1 2 D98-4344-33
<b>Metals, Total</b>	UNITS							
<b>Lead, Total</b>	mg/Kg	20.8 DJ*	16 DJ*	169 DJ*	50 DJ*	13.2 DJ*	1,850 DJ*	21 DJ*
<b>Physical Properties of Soil</b>	UNITS							
<b>pH</b>	SU	NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B33/DP1 06/05/1998 0 1 D98-4344-34	A08B33/DP2 06/09/1998 1 2 D98-4344-35	A08B34/DP1 06/09/1998 0 1 D98-4343-1	A08B34/DP2 06/09/1998 1 2 D98-4343-2	A08B35/DP1 06/09/1998 0 1 D98-4343-3	A08B35/DP2 06/09/1998 1 2 D98-4343-4	A08B35/DP3 06/09/1998 2 3 D98-4343-5
<b>Metals, Total</b>	<b>UNITS</b>							
<b>Lead, Total</b>	<b>mg/Kg</b>	<b>59.6 DJ*</b>	<b>9.97 DJ*</b>	<b>194 J*</b>	<b>57.3 J*</b>	<b>274 J*</b>	<b>21.3 J*</b>	<b>15.7 J*</b>
<b>Physical Properties of Soil</b>	<b>UNITS</b>							
<b>pH</b>	<b>SU</b>	<b>8.2 J*</b>	<b>8.5 J*</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation



**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B36/DP1 06/09/1998 0 1 D98-4343-6	A08B36/DP2 06/09/1998 1 2 D98-4343-7	A08B37/DP1 06/10/1998 0 1 D98-4343-8	A08B37/DP1D 06/10/1998 0 1 D98-4343-9 Duplicate	A08B37/DP2 06/10/1998 1 2 D98-4343-10	A08B37/DP3 06/10/1998 2 3 D98-4343-11	A08B38/DP1 06/10/1998 0 1 D98-4343-12
Metals, Total	UNITS							
Lead, Total	mg/Kg	54.2 J*	18.4 J*	37.9 J*	1,270 J*	14.2 J*	12.8 J*	96.2 J*
Physical Properties of Soil	UNITS							
pH	SU	NA	NA	8.9	8.5	8.1 J*	8.2 J*	NA

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B38/DP2 06/10/1998 1 2 D98-4343-15	A08B39/DP1 06/10/1998 0 1 D98-4343-16	A08B39/DP2 06/10/1998 1 2 D98-4343-17	A08B40/DP1 06/10/1998 0 1 D98-4343-18	A08B40/DP2 06/10/1998 1 2 D98-4343-19	A08B41/DP1 08/24/1998 0 1 363831	A08B41/DP2 08/24/1998 1 2 363832
Metals, Total	UNITS							
Lead, Total	mg/Kg	18.7 J*	18.1 J*	11 J*	110 J*	51.6 J*	5,690 F	79.2 F
Physical Properties of Soil	UNITS							
		NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B42/DP1 08/24/1998 0 1 363829	A08B42/DP2 08/24/1998 1 2 363830	A08B43/DP1 08/24/1998 0 1 363827	A08B43/DP2 08/24/1998 1 2 363828	A08B44/DP1 08/24/1998 0 1 363825	A08B44/DP2 08/24/1998 1 2 363826	A08B45/DP1 08/24/1998 0 1 363822
Metals, Total	UNITS							
Lead, Total	mg/Kg	11,500 F	434 F	62.8 F	22.3 F	44.5 F	42.9 F	32.8 F
Physical Properties of Soil	UNITS							
		NA	NA	NA	NA	NA	NA	NA

LEGEND:

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point: Date Sampled: Sample Depth From: Sample Depth To: Laboratory Number: Sample Type:		A08B45/DP2 08/24/1998 1 2 363823	A08B45/DP2D 08/24/1998 1 2 363824 Duplicate	A08B46/DP1 08/24/1998 0 1 363820	A08B46/DP2 08/24/1998 1 2 363821	A08B47/DP1 08/24/1998 0 1 363818	A08B47/DP2 08/24/1998 1 2 363819	A08B48/DP1 08/24/1998 0 1 363815
Metals, Total	UNITS							
Lead, Total	mg/Kg	19.7 F	22.1 F	58 J*	27.6 J*	13.6 J*	13.4 J*	60.4 J*
Physical Properties of Soil	UNITS							
		NA	NA	NA	NA	NA	NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-3**  
**AOC 8 Phases 1 and 2 Direct-Push Soil Results**  
**Armco Kansas City Facility**

Sample Point:		A08B48/DP2	A08B48/DP3
Date Sampled:		08/24/1998	08/24/1998
Sample Depth From:		1	2
Sample Depth To:		2	3
Laboratory Number:		363816	363817
Sample Type:			
Metals, Total	UNITS		
Lead, Total	mg/Kg	55,200 J*	13.6 J*
Physical Properties of Soil	UNITS		
		NA	NA

**LEGEND:**

B - Detected in the associated laboratory method blank  
R - Qualified as unusable in the QC evaluation  
NA - Not Analyzed

F - Detected in the associated equipment rinsate blank  
T - Detected in associated trip blank  
ND - Not Detected

J - Qualified as estimated by the laboratory  
U - Qualified as undetected by the laboratory

J\* - Qualified as estimated in the QC evaluation  
U\* - Qualified as undetected in the QC evaluation

**Table 24-4**  
**AOC 8 Soil Results Exceeding Screening Limits**  
**Armco Kansas City Facility**

Parameter	20 DAF SSL (mg/kg)	Sample with SSL Exceedence	Sample Depth (ft)	Sample Result (mg/kg)
Lead, Total	400	A08G02 / SR1	0 - 1	699 F
		A08G02 / SR1D	0 - 1	9,510 F
		A08G02A / SR1	0 - 1	757
		A08G02B / SR1	0 - 1	711
		A08G02E / SR1	0 - 1	460
		A08B05 / DP1	0 - 1	3,420 DF
		A08B06 / DP1	0 - 1	40,400 DF
		A08B06 / DP2	1 - 2	39,100 DF
		A08B07 / DP2	1 - 2	27,200 DF
		A08B07 / DP3	2 - 3	778 DF
		A08B09 / DP1	0 - 1	1,950 DF
		A08B10 / DP1	0 - 1	3,810 DF
		A08B10 / DP1D	0 - 1	45,600 DF
		A08B11 / DP1	4 - 5	11,200 DF
		A08B13 / DP1	0 - 1	494 DF
		A08B14 / DP1	0 - 1	32,500 DF
		A08B15 / DP1	0 - 1	10,200 DJ*
		A08B16 / DP2	1 - 2	1,020 DJ*
		A08B19 / DP1	0 - 1	1,770 DJ*
		A08B20 / DP1	0 - 1	3,000 DJ*
		A08B21 / DP1	0 - 1	28,300 DJ*
		A08B22 / DP1	0 - 1	1,910 DJ*
		A08B23 / DP1	0 - 1	25,500 DJ*
		A08B29 / DP1	0 - 1	939 DJ*
		A08B29 / DP2	1 - 2	35,200 DJ*
		A08B30 / DP1	0 - 1	6,190 DJ*
		A08B30 / DP1D	0 - 1	3,800 DJ*
		A08B32 / DP1	0 - 1	1,850 DJ*
		A08B37 / DP1D	0 - 1	1,270 J*
		A08B41 / DP1	0 - 1	5,690 F
		A08B42 / DP1	0 - 1	11,500 F
		A08B42 / DP2	1 - 2	434 F
		A08B48 / DP2	1 - 2	55,200 J*

**Notes:**

D = Sample was diluted for analysis.

DAF = Dilution Attenuation Factor

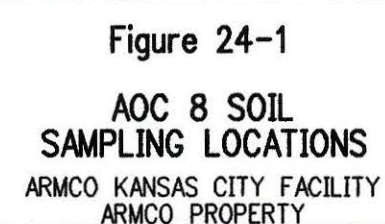
F = Compound was detected in corresponding equipment rinsate blank.

ft = feet

J\* = Qualified as estimated by BMWCI during the QC evaluation.

SSL = Soil Screening Level

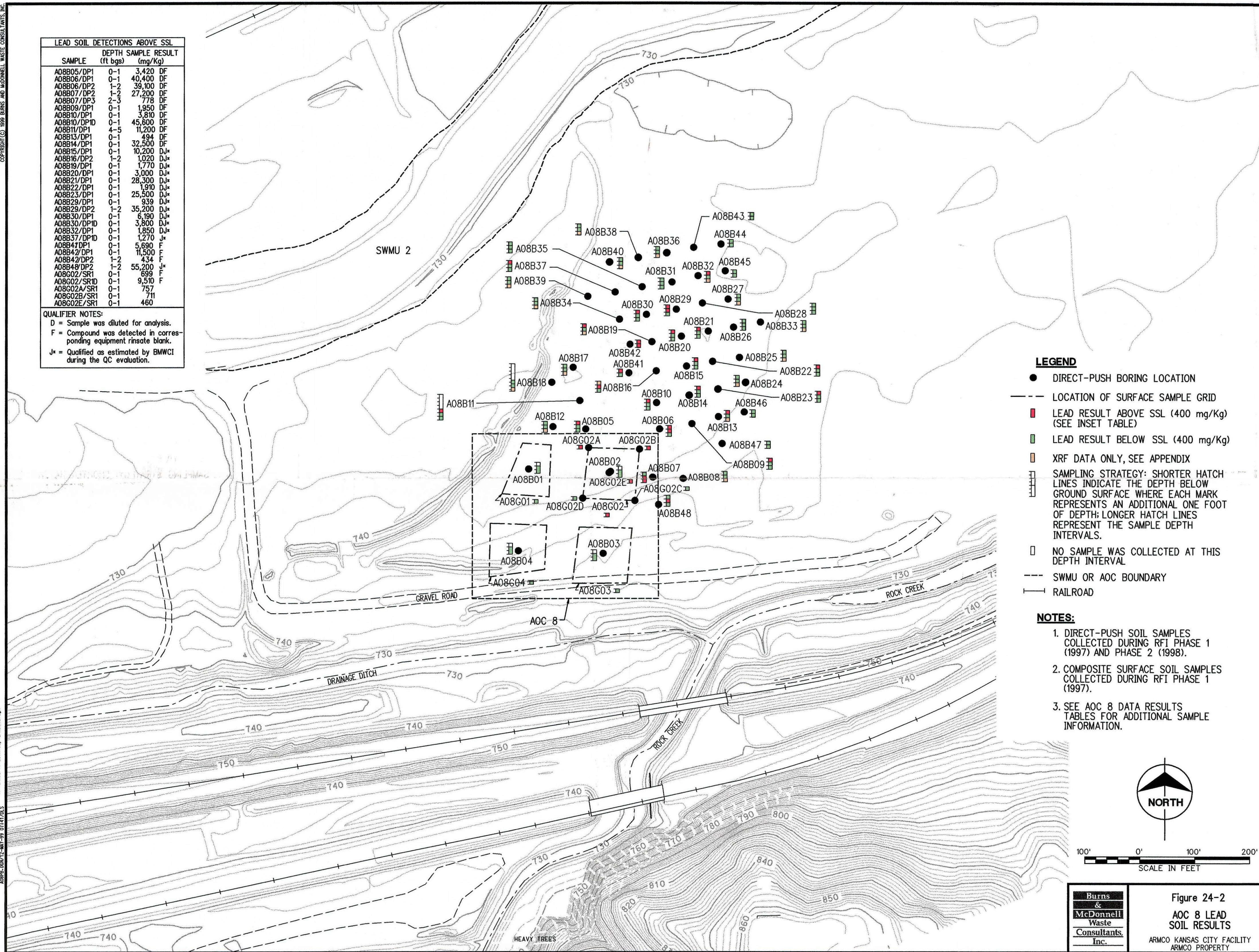






LEAD SOIL DETECTIONS ABOVE SSL			
SAMPLE	DEPTH (ft bgs)	SAMPLE RESULT (mg/Kg)	
A08B05/DP1	0-1	3,420	DF
A08B06/DP1	0-1	40,400	DF
A08B06/DP2	1-2	39,100	DF
A08B07/DP2	1-2	27,200	DF
A08B07/DP3	2-3	778	DF
A08B09/DP1	0-1	1,950	DF
A08B10/DP1	0-1	5,810	DF
A08B10/DP1	0-1	45,600	DF
A08B11/DP1	4-5	11,200	DF
A08B13/DP1	0-1	494	DF
A08B14/DP1	0-1	32,500	DF
A08B15/DP1	0-1	10,200	DJ*
A08B16/DP2	1-2	1,020	DJ*
A08B19/DP1	0-1	1,770	DJ*
A08B20/DP1	0-1	3,000	DJ*
A08B21/DP1	0-1	28,300	DJ*
A08B22/DP1	0-1	1,910	DJ*
A08B23/DP1	0-1	25,500	DJ*
A08B29/DP1	0-1	939	DJ*
A08B29/DP2	1-2	35,200	DJ*
A08B30/DP1	0-1	6,190	DJ*
A08B30/DP1D	0-1	3,800	DJ*
A08B32/DP1	0-1	1,850	DJ*
A08B37/DP1D	0-1	1,270	J*
A08B41/DP1	0-1	5,690	F
A08B42/DP1	0-1	11,500	F
A08B42/DP2	1-2	434	F
A08B48/DP2	1-2	55,200	J*
A08G02/SR1	0-1	699	F
A08G02/SR1D	0-1	9,510	F
A08G02A/SR1	0-1	757	F
A08G02B/SR1	0-1	711	F
A08G02E/SR1	0-1	460	F

QUALIFIER NOTES:  
D = Sample was diluted for analysis.  
F = Compound was detected in corresponding equipment rinsate blank.  
J\* = Qualified as estimated by BMWCI during the QC evaluation.

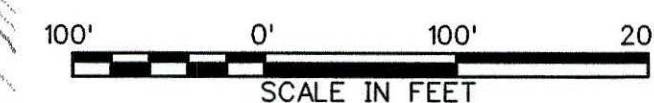


# LEGEND

- DIRECT-PUSH BORING LOCATION
- LOCATION OF SURFACE SAMPLE GRID
- LEAD RESULT ABOVE SSL (400 mg/Kg) (SEE INSET TABLE)
- LEAD RESULT BELOW SSL (400 mg/Kg)
- XRF DATA ONLY, SEE APPENDIX
- ▤ SAMPLING STRATEGY: SHORTER HATCH LINES INDICATE THE DEPTH BELOW GROUND SURFACE WHERE EACH MARK REPRESENTS AN ADDITIONAL ONE FOOT OF DEPTH; LONGER HATCH LINES REPRESENT THE SAMPLE DEPTH INTERVALS.
- NO SAMPLE WAS COLLECTED AT THIS DEPTH INTERVAL
- SWMU OR AOC BOUNDARY
- RAILROAD

# NOTES:

- DIRECT-PUSH SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997) AND PHASE 2 (1998).
- COMPOSITE SURFACE SOIL SAMPLES COLLECTED DURING RFI PHASE 1 (1997).
- SEE AOC 8 DATA RESULTS TABLES FOR ADDITIONAL SAMPLE INFORMATION.



Burns  
&  
McDonnell  
Waste  
Consultants,  
Inc.

Figure 24-2  
AOC 8 LEAD  
SOIL RESULTS  
ARMCO KANSAS CITY FACILITY  
ARMCO PROPERTY



## **CONTAMINANT FATE AND TRANSPORT POTENTIAL**

## **25.0 CONTAMINANT FATE AND TRANSPORT POTENTIAL**

This chapter summarizes the fate and transport potential for organic and inorganic constituents detected during the RFI at the Facility. In general, constituents introduced into the environment may adsorb onto soils, leach from soil into migrating water, dissolve into water, volatilize from soil and water into the atmosphere, or be taken up from soil by vegetation. These are known as "transport" processes. In addition, a constituent may undergo degradation processes that form other constituents. These are called "fate" processes. The fate and transport of constituents is dependent largely on the chemical and physical properties of the constituents themselves. These properties govern the ability of a chemical to move through a medium via potential migration pathways.

### **25.1 ORGANICS**

In this section, fate and transport potential is evaluated for organic chemicals most commonly detected at the Facility, which included VOCs and SVOCs. Within the VOC and SVOC discussions, the most commonly detected contaminants are specifically evaluated. Table 25-1 provides the chemical-physical properties for the most commonly detected contaminants at the Facility. Although not all contaminants detected at the Facility are presented on Table 25-1, all were evaluated, as appropriate, in the risk assessment.

The following references were used to develop the information presented within this section: ATSDR, 1995; Dragun, 1988; Howard, 1989; Howard, 1990; Howard et al, 1991; and Ney, 1995.

#### **25.1.1 Factors Influencing Fate and Transport**

Contaminant behavior in the environment is an important determinant of exposure pathways and concentrations. Behavior of contaminants is a function of the physical and chemical properties specific to the contaminant as well as characteristics of the matrix or matrices in which the contaminant exists or moves. Important contaminant-specific properties include water solubility,

#### **25.1.1.3 Henry's Law Constant**

Henry's Law constant incorporates molecular weight, solubility, and vapor pressure to indicate the degree of volatility of a chemical in solution. A chemical with a Henry's law constant greater than  $1\text{E-}03$  atmospheres-cubic meters/mole (or  $\text{atm-m}^3/\text{mol}$ ) is considered highly volatile, and a chemical with a Henry's Law constant less than  $3\text{E-}07$   $\text{atm-m}^3/\text{mol}$  is considered nonvolatile. Henry's Law constant is conventionally expressed as a ratio of partial pressures in the vapor to the concentration in the liquid. It is, therefore, a coefficient that reflects the air-water partitioning.

#### **25.1.1.4 Octanol-Water Partitioning Coefficient ( $K_{ow}$ )**

The  $K_{ow}$  value is the ratio of the concentration of an organic chemical in octanol divided by the concentration of the chemical in water.  $K_{ow}$  expresses the extent of chemical affinity for octanol versus water. This value gives an indication of how hydrophobic the chemical is and its potential to adsorb to soil or to bioaccumulate in organisms. The greater the  $K_{ow}$ , the more likely the chemical will accumulate in soil, sediment, and biota. A chemical with a low  $K_{ow}$  value tends to partition mostly to air or water. A chemical with a  $K_{ow}$  value greater than 1,000 is expected to adsorb to soil and to bioaccumulate, and a chemical with a  $K_{ow}$  value less than 500 is not expected to significantly adsorb to soil or to bioaccumulate. In general, as  $K_{ow}$  increases, bioaccumulation, persistence and absorption increase while water solubility, mobility, and biodegradation decrease.

#### **25.1.1.5 Organic Carbon-Water Partitioning Coefficient ( $K_{oc}$ )**

The  $K_{oc}$  value is a measure of the propensity for organic compounds to be adsorbed by organic carbon in soil and sediment. A high  $K_{oc}$  ( $>10,000$ ) indicates a chemical is expected to be adsorbed tightly to carbon-containing soil and to be less available for migration to water. A chemical with a  $K_{oc}$  value between 100 to 10,000 is expected to be moderately adsorbed. A low  $K_{oc}$  value ( $<100$ ) indicates a chemical is expected to be weakly adsorbed and available for migration.

present (which may serve as carbon sources or substrates). Typically, a chemical with high water solubility and low soil adsorption can efficiently biodegrade.

**Photolysis.** Photolysis (also known as photodegradation) is degradation/alteration of a chemical resulting from direct absorption of light. The end products resulting from photolysis vary and may be either a higher or lower molecular weight compound. Photolysis is not a significant process for chemicals that do not absorb ultra-violet (UV) light greater than 290 nanometers (nm).

**Hydrolysis.** Hydrolysis is a chemical reaction with water that cleaves a hydrolyzable group and breaks down a chemical. Only a limited number of chemicals (e.g., esters, aliphatic halogens, amides, carbamates, and phosphate esters) have hydrolyzable groups to which hydrolysis would occur at an appreciable extent.

**Photooxidation.** Photooxidation is the oxidation of a chemical under the influence of light by the reactions with alkylperoxy ( $\text{ROO}^\bullet$ ), hydroxyl radicals ( $\text{HO}^\bullet$ ), or singlet oxygen in water ( $^1\text{O}_2$ ).

#### 25.1.1.9 Site Specific Factors

Site-specific factors and physical properties of the soil and saturated zone matrix affect groundwater flow patterns and the behavior of chemicals released to the environment. Many of these factors were presented and discussed in greater detail in Chapter 2.0 of this Report.

Site-specific factors such as rainfall, temperature, wind, ground cover, and topography impact groundwater recharge rates, soil moisture content, runoff, volatilization rates, hydraulic gradient, and other environmental conditions. These factors may all affect contaminant migration potential.

Soil characteristics (including configuration, composition, porosity, permeability, cation exchange capacity, and organic carbon content) will influence rates of contaminant percolation, partitioning, and transport. Physical properties of the soil and saturated zone matrix such as



porosity, bulk density, permeability, and organic carbon fraction will influence groundwater flow rates, percolation rates, and chemical adsorption.

Site hydrogeologic characteristics reveal groundwater occurrence and flow patterns, including the potential for contaminants to migrate to and with groundwater.

#### **25.1.2 Fate and Transport of VOCs**

When VOCs were detected, the most common constituents were chlorinated VOCs. Of the chlorinated VOCs detected, TCE, cis-1,2-DCE, and vinyl chloride were the most commonly detected compounds. Although other chlorinated VOCs were detected (i.e., 1,2-DCA, PCE, trans-1,2-DCE, methylene chloride), their fate and transport potential will be relatively similar to and represented by the fate and transport potential described herein for TCE, cis-1,2-DCE, and vinyl chloride.

TCE, cis-1,2-DCE, and vinyl chloride are highly volatile compounds, as shown by their high vapor pressures and Henry's Law constants. Releases of liquid phase chlorinated VOCs to the environment (such as to surface water or surface soil) are typically expected to volatilize into the atmosphere. Once in the atmosphere, TCE, cis-1,2-DCE, and vinyl chloride are expected to degrade fairly rapidly by atmospheric photooxidation by reaction with hydroxyl radicals.

$K_{ow}$  values for TCE, cis-1,2-DCE, and vinyl chloride are all in the low range.  $K_{oc}$  values for cis-1,2-DCE and vinyl chloride are in the low range, and the  $K_{oc}$  value for TCE is in the low end of the medium range. Overall, these compounds are not expected to adsorb significantly to soil. Based on  $K_{ow}$  values, they are not expected to bioaccumulate in the environment. Because of their low adsorption, they are available for migration to groundwater.

TCE, cis-1,2-DCE, and vinyl chloride all have high water solubilities. If these compounds are released to the soil, the low soil adsorption potential coupled with the high water solubility indicates that they will tend to migrate through the soil and leach to the groundwater. In the groundwater system, TCE, and cis-1,2-DCE may migrate vertically through the saturated zone

because their specific gravities are heavier than water. In contrast, the specific gravity of vinyl chloride is slightly less than water and therefore it should not theoretically migrate vertically through the saturated zone.

Biodegradation of TCE could occur under either aerobic or anaerobic conditions; however, with either scenario degradation rates are slow. Aerobic degradation potential increases with decreasing chlorination (such as for cis-1,2-DCE and vinyl chloride). Vinyl chloride will not degrade in an anaerobic environment (such as a typical groundwater saturated zone) and accumulation is typically observed.

Hydrolysis is not a significant factor for the degradation of TCE, cis-1,2-DCE, or vinyl chloride. Photolysis in water is not expected for TCE or cis-1,2-DCE; however, it may occur fairly rapidly for vinyl chloride in water containing sensitizers (i.e., humic acids or free radicals). Photooxidation of TCE in water may occur.

### **25.1.3 Fate and Transport of SVOCs**

PAHs were the most commonly detected SVOCs at the Facility. Of the PAH compounds, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene were most commonly detected. Although other PAH compounds were detected (e.g., indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene), the fate and transport potential for these PAH compounds are all relatively similar.

PAH compounds have moderate to low volatilities based on their vapor pressures and Henry's law constants, indicating that volatilization into the atmosphere is not significant. Once in the atmosphere, PAHs are expected to degrade by photolysis or photooxidation.

PAH compounds have low water solubilities and high  $K_{oc}$  and  $K_{ow}$  values, indicating strong soil adsorption. Thus, leaching to the groundwater and migration in the groundwater system is not expected to be significant. Due to the adsorption/desorption process, the movement of most PAHs would be substantially slower than the rate of groundwater flow. Therefore, locations

where several PAHs are detected are likely near the source of contamination. Specific gravities of the PAH compounds are greater than one, indicating they could move vertically through the saturated zone. This, however, is not expected due to their strong adsorption to soil.

PAHs may also bioaccumulate, as supported by their high  $K_{ow}$  values. However, most organisms metabolize and excrete PAHs rapidly, resulting in short-lived bioaccumulation.

The principal pathways for degradation of PAH compounds include aqueous and atmospheric photolysis, and atmospheric photooxidation. Biodegradation of PAHs in the soil or groundwater may occur in aerobic environments; anaerobic degradation occurs at a much slower rate than aerobic. Hydrolysis is not a significant degradation mechanism for PAHs.

## **25.2 INORGANICS**

In this section, fate and transport potential is evaluated for inorganics most commonly detected at the Facility including the metals arsenic, cadmium, and lead. Although not all metals detected at the Facility are specifically discussed herein, they will be evaluated, as appropriate, for the definition of nature and extent of contamination and in the risk assessment.

The following references were used to develop the information presented within this section: Adriano, 1986; Alloway, 1990; ATSDR, 1993; ATSDR, 1993a; ATSDR, 1997; and Dragun, 1988.

### **25.2.1 Factors Influencing Fate and Transport**

Several factors influence the potential fate and transport of metals in the environment. These factors include soil properties and the species of the metal itself. These properties as they influence fate are discussed in more detail below.

### 25.2.1.1 Soil Properties

The mobility of inorganics in soil is dependent on several physical and chemical properties in the soil system: pH, cation exchange capacity (CEC), adsorption coefficient ( $K_d$ ), and reduction/oxidation (redox) potential.

**pH.** pH is expressed as the negative log of  $H^+$  in moles per liter. In general, the capacity of soil to retain inorganics increases as the pH increases, but an exception includes arsenic. The maximum metals retention capacity of soil generally occurs at neutral to slightly basic conditions.

**CEC.** Cation exchange is the exchange between cations balancing the surface charge of the soil surface and the cations dissolved in water. The total amount of cations adsorbed by these negative charges on a unit mass of soil is defined as the CEC of the soil.

The CEC of a soil is dependent upon organic matter, clay, and oxide contents. In general, the ability of soil to retain metals increases with increasing CEC values. Some metals have a high affinity for organic matter, also known as humus. These metals form complexes with the carboxyl and phenolic functional groups in the organic matter. In general, CEC increases with clay content, thereby increasing the cation retention capacity. Oxides of iron, manganese, and aluminum also tend to sorb and complex metals.

**$K_d$ .** The adsorption coefficient,  $K_d$ , is the ratio of the concentration of an ion adsorbed on soil surfaces to the concentration of that ion in water. The greater the extent of adsorption, the greater the magnitude of  $K_d$ . In general, trivalent cations are preferentially adsorbed over divalent cations, which are preferentially adsorbed over monovalent cations. Because the magnitude of  $K_d$  is dependent upon the size and charge of the cation and upon those soil properties governing the exchange sites on soil surfaces, and because these soil properties vary widely among soils, an element's  $K_d$  will also vary widely among soils.

**Redox.** Redox potential refers to reducing or oxidizing conditions of the soil. Redox is measured as "Eh," which is a measure of electron activity. Redox influences the complex form

of the metal, and some metals (e.g., cadmium, lead) can form insoluble sulfide complexes under reducing conditions.

#### **25.2.1.2 Metals Species**

A metal can exist in the environment in a variety of forms, or species (ionic form or complex form) in various media depending on the media's redox and pH. These forms can have different valences and therefore, different mobilities and solubilities. For instance, metals may exist as charged particles, such as ions in solution, or in an uncharged (i.e., neutral state). Metals may also interact with both inorganic and organic species to form a variety of different complexes of variable solubilities. Multiple oxidation states of some metals further complicate their behavior.

Analytical procedures (as provided in approved Workplans) used to determine metal concentrations did not distinguish between metal speciation or oxidation state. Thus, the exact nature of the metal in the media of concern has not been distinguished.

#### **25.2.2 Fate and Transport of Metals**

General fate and transport information for metals is presented in this subsection. Following this general discussion, specific information on arsenic, cadmium, and lead is then provided.

In general, the chemical fate and persistence characteristics of inorganic compounds are similar. Metals are found naturally in soil as elemental constituents and cannot be destroyed by physical, chemical, or biological degradation. Metals exhibit low water solubility and volatility, and are typically considered insoluble and nonvolatile. Metals form a variety of complexes that determine mobility, but they are generally considered permanent and persistent in the environment until removed by some transport process.

The potential for migration of any metal complex depends on its solubility in water. Metals in solution exist in an ionic form. These ions may be transported as such, or undergo processes such as adsorption to organic matter or mineral surfaces of sediment, soils, and suspended solids. Nonionic forms tend to precipitate and remain bound to sediments and soil or they may be

transported as suspended solids. Metals may cycle between the aqueous and solid phases with limited actual migration.

Mechanisms such as adsorption and precipitation will prevent movement of the metals from soil to groundwater. Metal-soil interaction is such that when metals are introduced at the soil surface, downward transportation does not occur to any great extent unless the metal retention capacity of the soil is overloaded, or metal interaction with the associated waste matrix enhances mobility. Changes in soil environmental conditions over time, such as pH, redox potential, etc., may enhance metal mobility.

In general, soils with higher CEC values and percentages of clay, such as those found in the vadose zone soil at the Facility, have a higher attenuation capacity for metal ions. With these conditions and typically a neutral or slightly basic pH, minimal migration of metals in the soil is expected.

Due to the typically strong adsorption of metals to soil particles, migration could occur through the air pathway (e.g., through dust migration) or through sediment migration.

#### **25.2.2.1 Arsenic**

Arsenic can exist in four oxidation states:  $3^-$ , 0,  $3^+$ , and  $5^+$ . Arsenic typically exists in either the  $5^+$  or  $3^+$  oxidation state. Arsenate ( $5^+$ ) is the stable ion in aerobic soils. Under moderately reducing conditions, arsenite ( $3^+$ ) is typically present and is more soluble than arsenate.

Arsenic in soil typically occurs in the insoluble (arsenate) adsorbed form. Arsenic is commonly associated with sulfide-containing minerals, and these sulfide complexes are relatively insoluble. In slightly reduced soils, the more soluble arsenite may be present. Arsenic adsorption in soil increases significantly with increases in iron and aluminum oxide concentrations, since arsenic tends to form complexes with these oxides in acidic soils. As the pH of soil increases, the more soluble calcium complexes become prevalent. Normal oxidizing conditions in soil lead to the



formation of arsenic oxyanions. These complexes can be altered further by microorganisms, which can produce volatile forms of the metal.

In surface water and groundwater, arsenic is typically found as arsenate. Microorganisms may reduce arsenate to arsenite.

In the atmosphere, arsenic exists typically in the particulate form and is removed from the atmosphere by wet or dry deposition.

Bioaccumulation of arsenic occurs in aquatic organisms, but biomagnification does not appear to be significant. Plants may accumulate arsenic by root uptake from the soil or by leaf adsorption. However, they do not typically accumulate arsenic at levels that could be toxic to humans. Instead, the growth of plants is inhibited by arsenic.

#### **25.2.2.2 Cadmium**

Cadmium exists in one oxidation state,  $2^+$ .

Cadmium in soil, typically present as the  $2^+$  ion, is likely to adsorb to soil. Adsorption increases as pH increases within the approximate range of 5 to 9. Cadmium is relatively mobile at pH values outside this range and may be transported as hydrated cations, inorganic complexes or organic complexes. Hydrous oxides will bind to cadmium and are an important factor in retaining cadmium in soil.

In surface water or groundwater, cadmium tends to be more mobile than other heavy metals. Cadmium is typically present as the  $2^+$  ion; however, high organic content may form organic complexes of cadmium. Cadmium is not strongly influenced by the redox conditions of the water; however, less soluble cadmium sulfide complexes may form under reducing conditions.

In the atmosphere, cadmium is typically found as particulate and may be removed from the atmosphere by wet or dry deposition.

Cadmium is strongly bioaccumulated in aquatic and terrestrial food chains. However, since cadmium does not tend to adsorb in muscle tissue, biomagnification through the food chain may not be significant.

#### **25.2.2.3 Lead**

Lead exists in two oxidation states:  $2^+$  and  $4^+$ . In the environment, lead primarily occurs in the  $2^+$  oxidation state.

Lead is strongly retained by most soils. At pH 6 to 8, soils with high organic matter content tend to form generally insoluble organic-lead complexes and soils with lower organic material tend to form hydrous lead oxide, carbonate, or phosphate complexes. The carbonate and phosphate complexes are generally insoluble. Under anaerobic conditions, microorganisms may form the organo complex tetramethyl lead, a relatively volatile form. As the pH of the soil decreases below 6, lead becomes more mobile.

Lead is not typically found in the dissolved form in most surface water or groundwater at neutral pH. Lead will form compounds with anions in the water (e.g., hydroxides, carbonates, sulfates, or phosphates) that have low water solubilities and will precipitate out of the water column.

In the atmosphere, inorganic complexes of lead exist typically in the particulate form and are removed from the atmosphere by wet or dry deposition. Organic complexes of lead typically exist in the vapor phase and rapidly degrade by direct photolysis, reactions with hydroxyl radicals, and/or reactions with ozone to form inorganic lead ions.

Although lead may bioaccumulate, biomagnification is not expected in aquatic or terrestrial food chains. Since lead is strongly adsorbed to soil and does not readily leach from soil due to its low solubility, bioavailability of lead in soil to plants by root uptake is typically low. Plants may also uptake lead through leaf adsorption. This bioavailability may increase as the pH and organic

matter content decrease. However, as lead concentrations in soil increase, lead will accumulate and may eventually become available for plant uptake.

### 25.3 MODELING

Subsurface transport modeling of unsaturated and saturated zone contamination was considered for the Facility. Information gained from the transport modeling may have been used for developing allowable chemical concentrations necessary to protect humans and aquatic species at the potential receptor location. Computer codes selected for the transport modeling were the Seasonal Soil Compartment Model (SESOIL), MODFLOW, and MT3D. SESOIL is used to determine whether contamination in the unsaturated soil will migrate to the groundwater and if so, determine at what rate contaminants will enter the groundwater. MODFLOW/MT3D is used to simulate the migration of dissolved contaminant concentrations (both those existing in the defined groundwater plume and those predicted by the SESOIL-determined contaminant mass loading from the unsaturated zone) to a downgradient receptor.

The SWMU 33 area was considered an appropriate area for subsurface transport modeling based on a well defined unsaturated zone contaminant source area, well defined groundwater contaminant plumes (based on an adequate groundwater monitoring well network), adequate groundwater table elevation data, and a downgradient receptor point. Therefore, it was conceptualized to model detected VOC constituents in the soil and groundwater in the SWMU 33 area to the Blue River. However, a combination of factors in the SWMU 33 subsurface made this particular area overly complex for groundwater transport model development. These factors included the following:

- Limited and uncertain hydraulic connection between groundwater and the Blue River owing to the concrete flood control channel around the SWMU 33 perimeter.
- The preponderance of fine grained (clay and silty clay) sediments characteristic of the Blue River dominated valley floor that exhibit a high degree of vertical and lateral variability.

- Semi-confined saturated zone conditions in the deep monitoring well network but no well-defined, laterally continuous confining layer(s).
- Possible hydraulic influence exerted by the abandoned subsurface basements, foundations, and storm sewer network related to the former mill buildings throughout the area.

Development of a groundwater transport model was attempted but calibration of the model was not feasible based on the variations and limitations of the site-specific data obtained during the RFI. All of the factors noted above added complexity that made the selection of modeling parameters subjective, which may have yielded questionable results. Therefore, neither unsaturated zone nor saturated zone transport modeling was performed.

\* \* \* \* \*

**Table 25-1**  
**Chemical Physical Properties**  
**Armco Kansas City Facility**

Chemical	CAS Number	Molecular Weight g/mol	Water Solubility mg/L	Vapor Pressure torr	Henry's Law Constant atm-m <sup>3</sup> /mol	K <sub>ow</sub>	K <sub>oc</sub> L/Kg	Air Diffusion Coefficient cm <sup>2</sup> /s	Specific Density
<b>Volatile Organic Compounds</b>									
cis-1,2-Dichloroethene	156-59-2	96.95	3.50E+03	2.00E+02	4.08E-03	7.24E+01	3.55E+01	7.36E-02	1.28
Trichloroethene	79-01-6	131.4	1.10E+03	7.50E+01	1.03E-02	5.13E+02	1.66E+02	7.90E-02	1.4
Vinyl Chloride	75-01-4	62.5	2.76E+03	2.66E+03	2.70E-02	3.16E+01	1.86E+01	1.06E-01	0.91
<b>Semivolatile Organic Compounds</b>									
Benzo(a)anthracene	56-55-3	228.3	9.40E-03	2.00E-07	3.35E-06	5.01E+05	3.98E+05	5.10E-02	1.11
Benzo(a)pyrene	50-32-8	252.3	1.62E-03	5.68E-04	1.13E-06	1.29E+06	1.02E+06	4.30E-02	1.11
Benzo(b)fluoranthene	205-99-2	252.32	1.50E-03	1.56E+03	1.11E-04	1.58E+06	1.23E+06	2.26E-02	1.02
Dibenz(a,h)anthracene	53-70-3	278.35	2.49E-03	1.00E-10	1.47E-08	4.90E+06	3.80E+06	2.02E-02	1.282

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